The Value of Intangible Capital and its Components in Mergers

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Abstract

In a large sample of U.S. domestic M&As over 1993-2014, we examine whether the market perceives transfer of intangible capital in mergers to be value enhancing. We find that acquirer announcement-period abnormal returns are significantly higher in acquisitions where acquirers have relatively lower intangible capital than targets. This supports the hypothesis that value is created for acquirer shareholders in the mergers involving intangible capital transfer from targets to bidders. Further, we find that the greater the target's intangible assets relative to those of the acquirer's, the higher the synergy created by an acquisition. This indicates that acquisitions by firms with relatively lower intangible capital generate higher total gains.

JEL Classification: G3, D2

Keywords: Intangible capital, Market for Corporate Control, Acquisitions, Takeovers, Agency Problems, Event Study

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I Introduction

Intangible assets - referring to rights, privileges, and competitive edges derived from the ownership of long-lived non-physical assets - are an essential and increasing part of the capital stock in the economy. Recent studies show that intangible capital has become a significant factor of production to firms and thus is capable of yielding abnormal returns, thereby generating firms' future growth[1]. It is worth noting that this unique type of investment is partly embedded within firms' products and employees and is therefore hard to duplicate by competitors. There is, however, a potential to transfer intangible capital from one firm to another, for example, from a target to the acquirer (Ranft & Lord, 2000). This paper will investigate whether the transfer of intangible capital occurs across firms in mergers and acquisitions (M&As). The investigation will also identify whether such transfer contributes to takeover gains.

Firms invest in intangible assets in two ways: a) internally create and b) externally purchase. Internally created intangible assets are developed primarily by investing in self-innovation activities. When such investments are commercially successful, they are transformed into intangible capital and create corporate value and growth. As it is challenging and costly to create intangible assets, firms often prefer to obtain access to such assets through external purchases (Lev, 2000). However, because intangible assets are embedded in tangible products such as software-operated machine tools or a key labour input such as engineers and researchers, they can be difficult to quantify and trade, thus explaining the absence of separate markets for such assets. The acquisition of an entire firm may be a plausible way of buying or selling such intangible assets. Thus, the incentives to purchase or outsource intangible assets could be a motive for M&As.

In M&As, the value of intangible capital likely plays an important role, since the proportion of a firm's intangible capital relative to total capital appears to be large (Lev, 2000; Corrado & Hulten, 2010), and its contribution to firms' productivity and growth is significant. These traits raise

[1] Evidence shows a significant effect of intangible assets in economic and corporate performance. Including intangible capital as an input or an output has a significant impact on the understanding of economic growth (Corrado, Hulten, & Sichel, 2009). Firm-level estimates of intangible capital are positively related to firms' market valuation, performance, and future returns (Lev & Sougiannis, 1996; Gu & Wang, 2005; Matolcsy & Wyatt, 2008; Lev, Radhakrishnan, & Zhang, 2009)

investors' interest in intangible capital and may lead them to obtain such capital via M&As. The proprietary nature of intangible assets results in the heterogeneity of such assets between acquirers and targets, offering substantial opportunities for value creation through takeovers. The starting point for our investigation is the heterogeneity of intangible assets between acquirers and targets, and then we test the primary hypotheses on intangible capital transfer in M&As. Based on the evidence suggesting that firms with a relatively high proportion of intangible capital are more likely to become targets compared to those with a low proportion of intangible capital (Ranft & Lord, 2000; Faria, 2008), a positive intangible capital transfer from targets to acquirers can be expected to occur during a takeover. Therefore, the first hypothesis we put forward asks whether acquirers merge targets with a relatively high proportion of intangible capital. If the market values high-intangibles targets, does the intangible capital transfer from targets to acquirers have a positive valuation effect?

In contrast to physical assets, which are capitalized on the balance sheet, most intangible assets are usually expensed in the income statement, leading to the deficiency in the disclosure of intangibles. Information asymmetry related to this deficiency results in high-intangibles firms incurring excessive capital costs and thus suffering from underinvestment in innovation activities. Another possible consequence of this information asymmetry is the discounted prospects of investments in intangibles, leading to the undervaluation of firms with a high proportion of intangibles assets. In this situation, acquirers would be expected to capture benefits from the transfer of intangible capital across firms by utilizing the capital and mitigating the effects of a harsh investment environment for intangibles. Further, since intangible capital is generally tacit and therefore difficult to value in acquisitions, to better investigate the transfer effect of intangible capital and to reflect different innovation activities, two kinds of intangible capital are posited – knowledge capital and organization capital. Knowledge capital refers to patents, technologies, and other assets from the discovery and learning process; organization capital refers to human resource practice and organizational structures.

Inspired by Wang and Xie (2009), who examine the relationship between shareholder rights transfer and synergistic gains in M&As, we use the similar approach to test the relationship between intangible capital transfer and abnormal announcement returns in M&As. The intangible capital transfer in a merger is measured as the target's intangible capital *minus* the acquirer's

intangible capital. A positive intangible capital transfer indicates that the target firm holds a higher proportion of intangible assets than the acquirer prior to the merger. Following earlier studies on measuring intangible capital (e.g., Lev & Radhakrishnan, 2005; Eisfeldt & Papanikolaou, 2013, 2014; Peters & Taylor, 2017), we rely on the stock of knowledge capital estimated by capitalizing research and development (R&D) expenses and the stock of organization capital estimated by capitalizing selling, general, and administrative (SG&A) expenses. The motive for this approach is that R&D expenses are related to knowledge capital such as patents, technologies, and software, and a part of SG&A expenses are related to organization capital such as employee training, compensation systems, and organizational designs. The sum of capitalized expenses constitutes the off-balance-sheet intangible capital, namely, intangible capital not shown on a firm's balance sheet. Proxies for total intangible capital are estimated by combining the off-balance-sheet intangibles with intangibles that are included on the balance sheet. Event study methodology is then used, i.e., estimates cumulative abnormal announcement returns over a five-day window [-2, +2] based on the market model as proxies for acquisition announcement performance. Following Bradley, Desai, and Kim (1988) and Wang and Xie (2009), we construct synergy, the combined returns of the acquirer and the target, for each acquisition using a value-weighted portfolio of the acquirer and the target's abnormal announcement returns as a proxy for the total value creation through the acquisition.

In a sample of 1,607 completed domestic acquisitions by public U.S. firms from 1993 to 2014, the following patterns are observed. First, the average value of targets' intangible capital minus acquirers' intangible capital appears to be positive, suggesting that bidders tend to take over firms with higher level of intangible capital to accumulate such capital. Second, the intangible capital transfer from targets to acquirers has a significantly positive impact on acquirer abnormal returns around announcement day. A one standard deviation (56%) increase in intangible capital transfer leads to a 47 basis point increase in acquirer abnormal announcement returns. However, there is no significant relationship between target abnormal announcement returns and the transfer of intangible capital, suggesting that this transfer positively affects the acquirer's shareholders but not necessarily benefit the target's shareholders. Third, tests of intangible capital transfer on the combined returns of targets and acquirers suggest that a one standard deviation (56%) increase in intangible capital transfer leads to a 54 basis point increase in the combined returns. This finding indicates that additional value is created for the combined firm through an M&A involving

intangible capital transfer from the target to the acquirer, as a result of the redeployment of assets and the mitigation of underinvestment and undervaluation. Further, when isolating the off-balance-sheet intangible capital, knowledge capital, and organization capital, the transfer effects on the acquirer and target abnormal announcement returns and combined returns largely hold. However, the magnitude of the contribution from the off-balance-sheet intangible capital transfers is higher than that from the total intangible capital transfer, and organization capital transfer contributes more than knowledge capital transfer to acquirer shareholders returns. This finding suggests that off-balance-sheet intangible capital and organization capital are more likely to create greater benefits for acquirers as well as the takeovers overall than knowledge capital. All results hold for alternative proxies for takeover abnormal announcement returns we considered and are robust when taking into account the influence of industry-level competition, diversification, and high-tech deals. Therefore, our study provides substantial evidence for the existence of intangible capital transfer and the value creation potential of intangible capital transfer from targets to acquirers.

This paper makes two significant contributions to the existing literature. First, it adds to the volume of M&As work by providing strong evidence that intangible capital transfer from targets to the acquirers is a plausible source of merger gains. Existing studies show nothing new in suggesting takeovers are motived by synergies, inefficient market misevaluation, the Q theory hypothesis, the hubris hypothesis, and market timing (e.g., Roll, 1986; Bradley et al., 1988; Shleifer & Vishny, 2003; Rhodes-Kropf & Viswanathan, 2004; Dong, Hirshleifer, Richardson, & Teoh, 2006). Wang and Xie (2009) propose that corporate governance transfer is one channel of value creation in M&As. A more recent study by Hegde and Mishra (2017) identifies strategic risk transfer as another potential channel of value creation in M&As. Our study shows that acquisitions in which acquirers with a relatively low proportion of intangible capital acquire targets with a high proportion of intangible capital create value for acquirers' shareholders and takeovers overall. In other words, bidders are able to improve the utilization of intangible capital that they acquire from targets and mitigate the underinvestment and undervaluation problems relating to targets' intangible capital.

Second, this paper offers new evidence suggesting that intangible investment is positively associated with firm performance. Prior studies have demonstrated that intangible input, output, and efficiency are significantly positively associated with a firm's value and performance (e.g.,

Lev & Sougiannis,1996; Chan, Lakonishok, & Sougiannis, 2001; Eberhart, Maxwell, & Siddique, 2004; Gu & Wang, 2005; Lev & Radhakrishnan, 2005; Lev, Sarath, & Sougiannis, 2005; Eberhart, Maxwell, & Siddique, 2008; Lev, Radhakrishnan, & Zhang, 2009; Hirshleifer, Hsu, & Li, 2013; Eisfeldt & Papanikoloau, 2013, 2014). In M&A settings, Bena and Li (2014) focus on intellectual capital and show that corporate innovation activities are a key factor driving acquisitions and positively affect merger outcomes. Li, Qiu, and Shen (2018) emphasize organization capital and find that acquirers with high organization capital achieve significantly higher long-run abnormal returns and higher post-merger stock performance. Our study combines both knowledge capital and organization capital and focuses on the transfer of intangible capital from targets to acquirers, instead of a firm's unilateral capital stock. More specifically, we observe that, on average, targets own higher intangible capital than acquirers, and intangible capital transfer from targets to acquirers contributes positively to acquirer abnormal announcement returns and overall acquisition synergy. After differentiating between total intangible capital and off-balance-sheet intangible capital, we find that the off-balance-sheet intangible capital transfer has a relatively significant impact on acquirer abnormal announcement returns comparing to total intangible capital transfer. By differentiating between knowledge capital and organization capital, we provide evidence that organization capital transfer from targets to acquirers contributes more to acquirer abnormal announcement returns than knowledge capital transfer does.

The rest of the paper is organized as follows. Section II summarizes related literature and develops our hypotheses based on previous work. Section III describes the sample construction and variables selection. Section IV presents empirical results of main regressions and test the effects of industry-level competition, diversification, and high-tech firms' combination. Robustness and sensitivity tests are present in Section V. We conclude in Section VI.

II Literature and Hypotheses

A. Related literature

This study is closely related to two areas covered by the literature. First, there is a considerable amount of literature on M&As demonstrating how mergers are performed and why a merger may take place. Studies devoted to the effect of takeovers on targets and acquirers have consistently concluded that target firms have significant positive abnormal returns (Jensen & Ruback, 1983; Jarrell, Brickley, & Netter, 1988; Andrade, Mitchell, & Stafford, 2001), whereas acquirers only gain slight, but not significant, positive returns (Asquith, Bruner, & Mullins 1983; Eckbo, 1983) or even make a small loss from the transactions (Dodd, 1980). Given that acquirers in takeovers do not appear to lose much, and targets obtain substantial positive abnormal returns, takeovers, in general, create value (Jensen & Ruback,1983).

The literature identifies several dominant motives for corporate takeover activities. First, economies of scale and economies of scope of M&As create synergies for shareholders and thus drive acquisition activities (Jensen & Ruback, 1983; Bradley et al., 1998). Second, the inefficient market misevaluation hypothesis argues that market inefficiency leads to the overvaluation of acquirers relative to targets, thus affecting takeover activities (Shleifer & Vishny, 2003). Third, the Q theory hypothesis proposes that mergers are a channel for reallocating physical capital to more productive projects and more effective managers and that merger waves can be a response to capital relocation opportunities (Jovanovic & Rousseau, 2002). Fourth, the hubris hypothesis suggests that managers' overconfidence in their ability to extract value through M&As drives mergers (Roll, 1986). Fifth, market timing and industry shock also contribute to merger activities, and industry shock causes firms and even industries to experience negative returns, which may explain the underperformance of acquirers (Harford, 2005).

More recent studies have strengthened a new line of research on value creation with respect to M&A activities. For instance, Wang and Xie (2009) demonstrate the value creation potential of corporate governance transfer from the acquirer to the target. In an acquisition in which acquirer's governance is transferred to target with relatively poor governance, target governance will be replaced and improved, resulting in better use of target's assets and thus creates value for the

takeover. Hegde and Mishra (2017) suggest that strategic risk transfer may be another channel of value creation in M&As. They find that target firms with excess risk aversion are likely to suffer from underinvestment and undervaluation and are therefore more valuable to acquirers that can restructure them. Acquisitions in which a risk-taking acquirer takes over a risk-avoiding target can generate significant value through the restructuring of the target. Our study attempts to highlight a possible alternative motive for mergers by demonstrating that the transfer of intangible capital from targets to acquirers generates additional value in a takeover.

The second area of the literature relates to intangible capital and its components. Previous studies have failed to outline a clear and consistent pattern with respect to the category of intangible capital. A possible reason for this is that intangible capital is usually generated by a combination of firms' resources, leading to the distinction between different intangible assets blurred. Lev (2000) categorizes intangible capital into three groups – discovery, human resources, and organizational practice – based on their relationship to the asset creator. Follow-up studies by Lev and Radhakrishnan (2005) and Lev et al. (2009) have also adopted this categorization when discussing organization capital. Eisfeldt and Papanikolaou (2013, 2014) describe organization capital as intangible capital embodied in firms' key talents. Furthermore, Corrado, Hulten, and Sichel (2009) and Hulten and Hao (2008) categorize intangible capital as R&D and organizational and human assets, while Peters and Taylor (2017) separate intangibles into knowledge capital and organization capital. Regardless of how intangible capital is categorized, these studies apply a similar underlying logic to estimate intangible capital. The stock of intelligence or knowledge capital is estimated as the capitalized R&D expenses, and the stock of organization capital or human assets is estimated as a fraction of capitalized SG&A expenses. The size of this fraction differs between studies that employ different definitions of organization capital. Our study follows the work of Peters and Tylor (2017) to categorize the stock of intangible capital into capitalized R&D expenses – the knowledge capital – and a fraction of capitalized SG&A expenses – the organization capital.

There is a growing literature that has studied knowledge capital and organization capital and established the relations between these investments and firms' value and performance. As elaborated by Lev (2000, pp.61), R&D, or knowledge capital, "is found to be an important contributor to firm's productivity, growth, and capital market value. The magnitude of this contribution – return on R&D investment – varies across industries and over time but is, by and

large, considerably higher than firms' cost of capital; hence the value creation capability of R&D". Empirical research supports that R&D expenses input, knowledge capital output, and innovation efficiency are significantly positively related to corporate future operating performance, expected stock returns, and market valuation. A number of studies, such as Lev and Sougiannis (1996), Eberhart et al. (2004, 2008), and Lev et al. (2005), demonstrate a positive association between R&D investment and future stock returns. The second group of studies, such as Gu and Wang (2005), Matolcsy and Wyatt (2008), and Cohen, Pandit, Wasley, and Zach (2011), reveal that the outcome of innovations, for example, the patent citations, are positively associated with firms' stock returns and future earnings. Hirshleifer et al. (2013) find that innovative efficiency, measured as patents and patent citations per dollar of R&D investment, is positively related to expect returns after controlling firm characteristics and risk. However, Jensen (1993) finds that investors are optimistic towards the outcomes of in-process R&D projects. Evidence from Chan et al. (2001) indicates that the average stock returns with R&D are comparable to returns without R&D because the stock price already incorporates the benefit generated by R&D spending. They argue that investors are overestimating the benefit from R&D because of the wide coverage of R&D intensive industries by popular media.

Organization capital is an agglomeration of technologies including human resource practices and unique structural and organizational designs that enable superior operation, investment, and innovation, and generate sustainable competitive advantages for the enterprises (Lev Radhakrishnan, & Zhang, 2009). It refers to the firm's ability to integrate human skill and physical capital into underlying systems and operating processes to deliver the desired products (Evenson & Westphal, 1995). The potential ability of organization capital to generate higher-than-average expected stock returns is supported by the studies of Lev et al. (2009) and Eisfeldt and Papanikoloau (2013, 2014). Therefore, organization capital is a persistent creator for a firm's value and growth.

As both knowledge and organization assets are value-relevant and contribute significantly to firms' growth, investors are increasingly interested in the intangible capital as an investment opportunity. However, two potential difficulties may be encountered when investing in intangible assets. First, compared with developing intangible assets internally, firms may prefer to purchase them externally due to the high cost of self-investment and the uncertain outcomes of the development

process (Lev, 2000). Second, intangible assets are inherently difficult to trade on their own. With respect to knowledge capital, it is difficult to designate innovation activities and share outcomes between parties (Lev, 2000). As for organization capital, its combination of underlying systems and information without a physical embodiment is tacit, so it is hard to trade and generally only transfers along with the ownership of a firm (Lev & Radhakrishnan, 2005). These obstacles may provide incentives for firms in need of intangible capital to accumulate such assets by taking over high-intangibles firms. For example, acquisitions in high-tech firms could be motivated by the advanced knowledge-based technologies and capabilities of target firms (Ranft & Lord, 2000). Another incentive for obtaining intangible capital by acquiring high-intangibles firms is the potential gains from the acquisitions. Gains from M&As may be perceived to exist if acquirers find it cheaper to acquire mature intangible assets externally than to create such assets internally by investing in R&D or organization capital, or if targets benefit more from the transfer of intangibles than from the potential long-term profits of intangibles (Faria, 2008).

In the M&A settings, the valuation of intangible capital is not the same as the valuation of physical capital. In contrast to the transparent disclosure of physical capital required in corporate financial statements, the current accounting disclosure environment for intangible capital, in which almost all intangibles are expensed in the income statement, leads to a failure in disclosing the value of intangible capital. Such information asymmetry caused by the lack of disclosure of intangibles to capital markets results in two consequences: the excessive cost of capital for intangible-intensive firms and the systematic undervaluation of intangible assets. Boone and Raman (2001) report a significant positive relationship between R&D expenditures and stock bid-ask spreads. The bid-ask spreads reflect the investors' transaction costs, which in turn affects firms' cost of capital. Shi (1999) and Chan et al. (2001) finds that increased R&D expenditures are associated with the increase in the cost of debt for listed firms. The high cost of capital may reduce the ability of intangible-intensive firms to generate sufficient funds to finance new projects and may, therefore, hamper firms' investment and growth. Lev et al. (2005) find that investors systematically undervalue young, intangible-intensive firms with a high R&D expenditures growth rate but a relatively low earnings growth rate. Firms with high R&D growth but low earnings growth indicate poor capital market performance, as investors are likely to discount the future profitability of these firms' R&D significantly. As a result, such firms are likely to be undervalued.

B. Hypotheses

Intangible assets are unique to firms and are difficult for competitors to mimic (Prescott & Visscher, 1980). This feature may lead to the heterogeneity of intangible capital among firms. For example, levels of intangible capital between acquirers and targets in takeovers are likely to differ. Evidence shows that young, small and underperforming firms, which are more likely to become targets according to Morck, Shleifer and Vishny (1990), have relatively low learning costs relating to new technologies and innovations and tend to undertake research, while large firms devote a much smaller proportion of their budget to R&D spending as they can gain access to innovations through acquisitions (Arrow, 1993). As a result, bidders with lower levels of intangible capital are more likely to acquire targets with higher levels of intangible capital. The existing literature outlines the potential for the transfer of intangible assets from one firm to another along with the transfer of a firm's ownership (Capron & Pistre, 2002; Lev & Radhakrishnan, 2005; Li et al., 2018). As bidders accumulate intangible capital by acquiring high-intangibles targets, the intangible capital transfer from the target to the acquirer can be expected.

Following the literature, the information asymmetry associated with the disclosure of intangible capital leads to a relatively demanding investment environment for intangible-intensive targets. Target firms with high levels of intangible capital may suffer from underinvestment due to the excessive cost of capital, which is comparatively low for bidders with low levels of intangible capital. Post-merger, acquirers not only obtain intangible capital from targets but also enable a relatively low financing cost towards investment in intangibles to alleviate previous underinvestment issues. With competitive intangible capital in-hand and with sufficient investment, acquirers should achieve higher takeover returns. In addition, because of the systematic undervaluation of intangibles resulting from the information asymmetry described above, targets with high levels of intangible capital tend to be undervalued and are thus worth more for acquirers. These arguments lead us to make the following prediction:

H1: Value is created for acquirer shareholders in the mergers involving intangible capital transfer from targets to bidders.

The value generated for acquirers should be at least partially reflected in their abnormal announcement returns. Thus, a positive association between acquirer abnormal announcement

returns and the intangible capital transfer from targets to bidders is expected from the first hypothesis.

Since firms' intangible capital comprises knowledge and organization capital, we next consider the effects of these two forms of intangible capital. Although knowledge capital is expected to generate abnormal returns because of its competitive edge, some studies (e.g., Hall, 1993; Chan et al., 2001) have failed to display its superior contribution to stock returns. One possible explanation is that the transparency of knowledge capital is increasing as a result of more in-depth media and analysts' coverage of R&D intensive firms and the accounting disclosure of the separately reported item of R&D expenses in firm's income statements (Lev, 2000; Chan et al., 2001). Increased transparency alleviates the information asymmetry related to knowledge capital, thus relieving pressure on the investment environment for R&D. Unlike knowledge capital, organization capital is relatively tacit since investment in organization capital is not reported separately in firms' financial statements. Expenditures on organization intangibles such as employee training, customer relationships, and brand enhancement, are generally combined with other expenses and captured as a fraction of SG&A spending. A review of the literature relating to intangible capital shows that a large number of studies have been conducted on knowledge capital from the 1980s onwards, but limited studies have documented organization capital systematically until the early 2000s. The research intensity does not necessarily result in an insufficient exploration of organization capital but may partially reflect the lack of transparency with respect to organization capital and information asymmetry for organization-capital-intensive firms. Thus, the transfer of organization capital from the target to the acquirer is expected to have a significant and positive effect on abnormal announcement returns. Further, this effect is expected to be stronger than the effect of the transfer of knowledge capital. We have the following sub-hypotheses:

H1a: Mergers involving knowledge capital transfer from targets to bidders will not be associated with higher acquirers' abnormal announcement returns.

H1b: Mergers involving organization capital transfer from targets to bidders are positively associated with higher acquirers' abnormal announcement returns.

Targets with high levels of intangible capital suffer from undervaluation and are discounted heavily by investors. A heavily discounted target is associated with a higher bid premium and

higher target abnormal announcement returns (Lang, Stulz, & Walkling, 1989), thus leading to the second hypothesis.

H2: Targets with higher than bidder's intangible capital receive higher premiums in mergers thus demonstrate higher abnormal announcement returns.

The combination of the above hypotheses suggests the conjecture that the reallocation of intangible capital is more appropriate and efficient. Evidence shows that after the transaction, intangible capital transferred from targets enhances acquirers' ability to achieve high innovative efficiency and generate extra earnings (Cassiman & Veugelers, 2006; Sun, 2014; Li et al., 2018). Besides, a target that accumulates a significant amount of intangible capital is likely to face financial constraints due to excessive capital costs, which in turn result in underinvestment in potential innovation projects. The entire acquisition should create value if the intangible assets are transferred to the acquirer with relatively low financing costs. Therefore, one possible positive outcome for overall acquisition is the synergistic gains from the transfer of intangible capital: The greater the intangible capital transfer from the target to the bidder the more synergies are created. Accordingly, the third hypothesis is posited:

H3: Mergers involving intangible capital transfer from targets to bidders are perceived to create synergy thus demonstrate higher abnormal announcement return for the combined firms.

III Data

A. Sample source

For the acquirers represented in the executive compensation database, acquisitions made between January 1, 1993, and December 31, 2014, available in Securities Data Corporation's (SDC) platinum U.S. Mergers and Acquisitions database are extracted, provided the following initial criteria are met as per Masulis, Wang and Xie (2007):

a. U.S. domestic completed mergers and acquisitions.

b. Both acquirers and targets are public firms.

c. Acquirers control less than 50% of shares in the target prior to announcement day and control 100% of the shares of targets after the transaction[2].

d. The deal value disclosed in SDC is more than $1 million and is at least 1% of the acquirer's market value of equity as measured on the 11th trading day prior to the announcement date[3].

e. For both acquirers and targets, annual financial statements and sufficient daily stock returns to estimate cumulative abnormal returns are available from Compustat and the Center for Research in Security Prices (CRSP) database, respectively.

f. Data on the replacement cost of intangible capital are available from the Peters and Taylor Total Q database on Wharton Research Data Services (WRDS).

[2] In our sample, most of the acquirers have no ownership in the targets prior to the announcement. The acquirers control a small portion of target shares only in 38 out of 1,607 acquisitions. The average percentage acquirers controlling prior to the announcement is 18.47% for the 38 acquisitions. This is consistent with what Wang and Xie (2009) reported.

[3] The constraints of deal value are borrowed from Moeller et al. (2004) and Masulis, Wang and Xie (2007).

Daily stock returns from CRSP are obtained to measure the deal performance for each firm using event study methodology. A total of 1,607 acquisitions from 1993 to 2014 satisfied the above requirements, thus constituting the final sample.

B. Variable construction

In this section, we will clearly explain the variables in three categories. Dependent variables include measures of acquisitions performance. Key explanatory variables are the proxies for intangible capital transfer. Control variables include the characteristics of firms, deals, and acquirers' CEOs.

Dependent variables

Following prior studies (see, i.e., Bradley et al., 1988; Masulis et al., 2007; Wang & Xie, 2009), we estimate the effects of acquisitions on stock prices of acquirers and targets surrounding the announcement date using the event study analysis. In other words, abnormal announcement returns of stocks are estimated to proxy for the announcement performance for bidders and targets. Our abnormal announcement returns, the difference between realized and expected returns, are measured based on the market model

$$AR_{it} = R_{it} - E(R_{it}) = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt} \qquad \text{(Equation III-1)}$$

where AR_{it} is the abnormal return for firm *i* on day *t*, R_{it} is the realized return for firm *i* on day *t*, $E(R_{it})$ is the expected returns measured by the market model, $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the market model parameter estimates, and R_{mt} is the CRSP value-weighted market index returns.

We obtain the acquisition announcement date for the individual firm from SDC platinum U.S. Mergers and Acquisitions database and define the announcement date as event day 0. For each firm, we estimate the market model parameters using 200 trading days returns from 212 days to 12 days prior to the announcement date. Ten days gap between the estimation period and the event window is applied to prevent the bias that may result from the information leak just before the announcement. Then we cumulate the daily abnormal returns over the event window [-2, +2] to obtain the cumulative abnormal returns (*CAR*) around the announcement date. The reason to

choose the event window [-2, +2] is that the announcement effects are captured most during this period without additional noise (Fuller, Netter, & Stegemoller,2002).[4]

We also examine how the combined returns for acquirers and targets perform when low-intangible acquirers takeover high-intangible targets. The combined returns are called synergy in our paper. Following Bradley et al. (1988), the synergy of an acquisition is measured as the weighted average of acquirer and target returns, where the weights are their market value as a portion of the sum of the acquirer and the target market value[5]. We compute the synergy using cumulative abnormal announcement returns of the market model during the five-day event window, denoted as *Synergy5*.

Key explanatory variables

According to the general principles governing accounting for intangible assets in APB (Accounting Principles Board) 17, paragraph 1, intangible assets depend on whether it is internally developed or externally acquired. Internally developed intangibles are mostly expensed in the income statement and rarely capitalized as assets[6]. Externally acquired intangibles are typically capitalized by the firm as part of the Intangible Assets item, either as Goodwill (if they cannot be identified separately) or as Other Intangible Assets (if they are separately identifiable), on the balance sheet. It is straightforward to figure out the amount of capitalized intangible assets according to the records of intangible assets on the balance sheet, but the amount of expensed inputs incurred to develop intangible assets that are not separately identifiable is relatively difficult to estimate (Peters & Taylor, 2017).

The stocks of knowledge capital and organization capital are estimated using the perpetual inventory method according to literature. The Bureau of Economic Analysis (BEA) uses the

[4] Our results hold if cumulative abnormal returns are estimated using the event window [-5, +5], and hold using Fama-French three-factor model and Fama-French plus momentum model as well.

[5] The definition of synergy in Bradley et al. (1988) assumes that acquisitions have no effects on the wealth of bondholders. This assumption is consistent with evidence in Kim and McConnell (1977) and Asquith and Kim (1982).

[6] There are a few exceptions: software development costs are required to capitalize and are amortized according to the expected lifelong of software products if the software is beyond the stage of technology feasibility; some minor intangibles, such as movie rights, legal costs and registration fees to develop patents and trademark, and commissions paid for life insurance and mortgage, can be capitalized as well; see FASB (1985b).

perpetual inventory method to compute the capital stock of R&D (Sliker, 2007). Hulten and Hao (2008) and Peters and Taylor (2017) also use a similar methodology to capitalize R&D expenses. Lev and Radhakrishnan (2005) estimate the stock of organization capital using reported SG&A expenses in income statement because this item includes part of inputs to generate organization capital, such as advertising to build brand, employees training costs, information technology costs, and outlays of setting up and maintenance systems. Hulten and Hao (2008), Eisfeldt and Papanikolaou (2013, 2014), Peters and Taylor (2017), and Li et al. (2018) also compute the stock of organization capital by accumulating the deflated value of SG&A expense using the perpetual inventory method.

To simplify the steps of the estimates, we follow the methodology from Peters and Taylor (2017) and employ their datasets directly[7]. They differentiate the intangible capital into two categories - knowledge capital and organization capital - and estimate them using the perpetual inventory method. To be specific, knowledge capital is estimated by accumulating past R&D spending

$$K_{it} = (1 - \delta_{R\&D})K_{i,t-1} + R\&D_{it} \qquad \text{(Equation III-2)}$$

where K_{it} is the stock of knowledge capital for firm i at the end of year t, $\delta_{R\&D}$ is the R&D depreciation rate, and $R\&D_{it}$ is real expenditure on R&D for firm i during year t. Peters and Taylor (2017) use constant R&D depreciation rates from the analysis of Li and Hall (2016) for ten R&D intensive industries identified in BEA's R&D Satellite Account. For other industries not included in Table 4 of Li and Hall (2016), they use 15% as R&D depreciation rates instead. The initial stock of knowledge capital K_{i0} is calculated using data of firm's first non-missing R&D Compustat record (coincides with the initial public offering, IPO), founding year, and the average growth rate. The assumptions to compute K_{i0} include that firm is founded with zero capital, and that pre-IPO R&D growth is the average change rate across pre-IPO Compustat records. Further details about the calculation are available in the Appendix of Peters and Taylor (2017).

Organization capital is estimated by accumulating a fraction (30%) of past SG&A spending using the same method,

[7] Peters and Taylor (2017) compute the replacement cost of intangible capital for U.S. public firms back to 1975. All estimates are available on Peters and Taylor Total Q database on WRDS.

$$O_{it} = (1 - \delta_{SG\&A})O_{i,\,t-1} + 30\%SG\&A_{it} \qquad \text{(Equation III-3)}$$

where O_{it} is the stock of organization capital for firm i at the end of year t, $\delta_{SG\&A}$ is the SG&A depreciation rate of 20% for all firms, and $SG\&A_{it}$ is real expenditure on SG&A for firm i during year t[8]. The value of O_{i0} is estimated using the similar method to compute K_{i0}. The remaining 70% of SG&A spending is explained as the firm's current period's operating costs.

Peters and Taylor (2017) further compute the off-balance-sheet intangible capital, namely, the portion of intangible capital that does not appear in the balance sheet, as the sum of the stocks of knowledge capital and organization capital estimated above, and calculate total intangible capital as the sum of externally purchased and internally created intangible capital, equivalently the sum of the on-balance-sheet *Intangible Assets* item and off-balance-sheet intangible capital. We scale the estimates of intangible capital and its components by firms' total assets in the same fiscal year.

Our key explanatory variables, the proxies for intangible capital transfer, are measured as the target's intangible capital *less* acquirer's intangible capital. More precisely, we define total intangible capital transfer (*DINT) as* total intangible capital of the target *less* total intangible capital of the acquirer; off-balance-sheet intangible capital transfer (*DOFFBS*) is target off-balance-sheet intangible capital *less* acquirer off-balance-sheet intangible capital; knowledge capital transfer (*DKNOW)* is the target's knowledge capital *less* acquirer's knowledge capital; organization capital transfer (*DORG)* is measured as the target's organization capital *minus* the acquirer's organization capital. The intangible capital (and its components) transfer is positive when the target has a higher level of intangible capital than the acquirer, or equivalently when the target's intangible capital transfer makes the acquirer's intangible capital increase. The higher the transfer of intangible capital, the greater the value that the acquirer would obtain from the target's intangibles. Therefore, as we discuss in the hypothesis section, we expect that intangible capital transfer has positive effects on acquirer abnormal announcement returns.

[8] According to Peters and Taylor (2017), SG&A is measured as Compustat variable *xsga* minus *xrd* minus *rdip*. If *xrd* is greater than *xsga* but less than *cogs*, or if *xsga* is missing, they measure SG&A as *xsga* or zero if *xsga* is missing.

Table III-1 Sample Description by Announcement Year

Table 1 presents the average of dependent variables and key test variables by announcement years. The sample consists of 1,607 completed US mergers and acquisitions listed in SDC from 1993 to 2014. *DINT*, *DKNOW*, *DORG* and *DOFFBS* represent the transfer from targets to bidders on intangible capital, knowledge capital, organization capital, and off-balance-sheet intangible capital, respectively. The variables are estimated at the end of fiscal year before the announcement day.

Year	ACQCAR5	Synergy5	DINT	DKNOW	DORG	DOFFBS	N
1993	-0.0101	0.0214	0.2438	0.1113	0.1686	0.2800	27
1994	-0.0160	0.0102	0.0077	0.0070	0.0156	0.0227	59
1995	-0.0138	0.0142	0.1992	0.1319	0.0623	0.1941	84
1996	-0.0030	0.0315	0.0634	0.0411	0.0576	0.0987	93
1997	-0.0124	0.0088	0.0760	0.0281	0.0534	0.0815	128
1998	-0.0285	-0.0040	0.1679	0.1042	0.0692	0.1734	129
1999	-0.0089	0.0115	0.0893	0.0635	0.0348	0.0983	158
2000	-0.0354	-0.0029	0.1787	0.0824	0.0979	0.1804	113
2001	-0.0195	0.0056	0.3077	0.1895	0.1272	0.3167	96
2002	-0.0143	0.0045	0.2423	0.1789	0.0787	0.2576	55
2003	-0.0174	-0.0045	0.1383	0.1032	0.0983	0.2016	74
2004	-0.0194	0.0162	0.1612	0.0707	0.1626	0.2333	74
2005	-0.0156	0.0080	0.2677	0.1612	0.1460	0.3072	67
2006	-0.0136	0.0109	0.1532	0.1002	0.0691	0.1692	70
2007	-0.0021	0.0147	0.4027	0.2097	0.2665	0.4762	73
2008	-0.0306	0.0070	0.4580	0.4712	0.1170	0.5882	48
2009	-0.0243	0.0005	0.3885	0.2983	0.0796	0.3779	40
2010	-0.0091	0.0231	0.1882	0.1383	0.1263	0.2646	57
2011	-0.0089	0.0284	0.4064	0.4086	0.0717	0.4803	32
2012	0.0124	0.0312	0.2192	0.0950	0.1460	0.2411	46
2013	0.0199	0.0525	0.6827	0.7211	0.0693	0.7904	42
2014	0.0083	0.0417	0.2114	0.1144	0.1534	0.2678	42

In Table 1, we present the sample description by acquisitions announcement year. From 1993, the number of acquisitions in each announcement year increases steadily, reaching the highest levels in 1999, and then drops off significantly before the rebound in 2003. The number is generally consistent until the decline from 2008 to 2014, despite a transitory increase in 2010. The trend is consistent with the trend in prior literature, such as Bhagat, Dong, Hirshleifer and Noah (2005), Wang and Xie (2009), and Li et al. (2018). Table 1 also presents the annual means of acquirer abnormal announcement returns, synergies, and transfers of intangible capital and its components from 1993 to 2014. Acquirer abnormal announcement returns (*ACQCAR5*) are slightly below zero for majority announcement years, and synergies are greater than zero except for the year of 1998, 2000, and 2003. The transfer of intangible assets, namely, *DINT*, *DKNOW*, *DORG*, and *DOFFBS*, are all greater than zero, implying a positive transfer of intangible capital in takeover transaction from the target to the acquirer.

Control variables

We consider three categories of variables related to the acquisition performance, including the characteristics of both parties of acquisitions, deals, and acquirers' CEO.

Firm characteristics: firm *size* (log transformation of the total assets), *Tobin's Q*, *leverage*, and return on assets (*ROA*) are controlled for both acquirers and targets in the light of correlation with dependent variables. Moeller, Schlingemann and Stulz (2004) point out that a size effect exists in takeovers: acquisitions undertaken by small acquirers tend to have 2.24% higher abnormal announcement returns than large acquirers after controlling for firm and deal characteristics and time effect. They claim that this effect could be explained by the managerial hubris hypothesis (Roll, 1986) - managers of relatively large firms tend to be overconfident and are likely to overpay for acquisitions. For *Tobin's Q*, different opinions appear. Lang et al. (1989) give evidence that returns of acquirers and targets are relatively higher when bidders with high *Tobin's Q* acquire targets with low *Tobin's Q*. However, the findings of Bhagat et al. (2005) and Wang and Xie (2009) suggest that bidder returns are negatively related to their *Tobin's Q*, which is consistent with our results. In our empirical tests, *Tobin's Q* is defined as the ratio of the market value of assets to the book value of assets, where the market value of assets is computed as the market value of outstanding stocks plus total assets minus common equity.

We also control firms' leverage because debt reduces free cash flow and improves managers' decision-making. Based on the free cash flow hypothesis of Jensen (1999), highly leveraged firms have less cash flow to spend and fewer resources to waste on bad M&As. Besides, leverage also pushes managers to improve management skill and enhance firm performance because they face the threat of bankruptcy (Grossman & Hart, 1982) or because they are monitored more closely by creditors (Harris & Raviv, 1990). Therefore, we expect acquisition performance to be positively associated with bidder's leverage. Following Wang and Xie (2009), we include return on assets (*ROA*) to proxy for a firm's profitability. As the higher the *ROA*, the better the firm performance, we expect *ROA* (defined as operating income before depreciation divided by total assets) to be positively related to the bidder's abnormal returns and overall synergies. We use Delaware State incorporation as a dummy variable for acquirers because shareholder rights in Delaware are stronger and more efficient than in other U.S. states (Romano, 1993). An alternative explanation is that Delaware has fewer constraints on charter rules and provides greater contractual freedom for shareholders and managers. These advantages allow managers to take action (i.e., involve in mergers) at a relatively low cost and thus increase the wealth of shareholders (Jensen and Ruback, 1993).

Deal characteristics: The deal characteristics we considered include: relative size ratio of target to acquirer, payment method, whether the acquisition is mergers of equals, whether the acquisition is a tender offer, whether target and acquirer are high-tech combinations defined by Loughran and Ritter (2004), whether the deal is diversifying, and whether transaction is a hostile takeover. Relative deal size ratio is controlled to adjust for size impact. Asquith et al. (1983) find that acquirer twenty-one-days abnormal announcement returns are positively associated with the relative size of the bidder to the target, but target abnormal returns are not related to the relative size. The acquirer abnormal returns of the acquisition with a relative ratio of 0.5 are 1.8% higher than the acquisition with a relative ratio of 0.1. However, Travlos (1987) find that relative size has an insignificant and negative effect on bidders' two-day abnormal returns. Payment method matters because equity offers have found to be negatively related to bidders' stock returns (Moeller et al., 2004; Travlos 1987). An acquisition paid with equity signals that the acquirer is overvalued to the market. A cash offer instead signals good news, so the returns of acquirers in cash offer will be higher than in stock offers.

It is well-known that mergers of equals rarely success, for example, the woeful tale of the marriage of Travelers and Citibank in April 1998 and Daimler and Chrysler in May 1998, so we control the effect of mergers of equals following Wang and Xie (2009). Moeller et al. (2004) find that acquirers have higher returns with tender offers because almost all tender offers are made by public firms and paid with cash. Following Masulis et al. (2007) and Wang and Xie (2009), we control the combinations of high-tech companies because high-tech mergers are likely to lower the acquirers' returns. Findings on the effect of diversification are mixed. Managers might pursue diversification to benefit themselves even when the transaction hurts the wealth of shareholders (Morck, Shleifer, and Vishny, 1990). Bhagat et al. (2005) also argue that diversification could be a signal for poor investment opportunities in the industry. However, Villalonga (2004) provides evidence that diversification is not necessarily value-destroying on average. Recent research on M&As also does not find a significant effect of diversifying mergers on shareholder returns (see, i.e., Masulis et al., 2007; Wang & Xie, 2009; and Li et al., 2018). Acquisitions identified as hostile on SDC may lead to lower acquirer returns due to the low success rate and high premiums for the target (Schwert, 2000).

CEO characteristics: CEO influences corporate decisions as well as firm performance, so we construct several important CEO characteristics, including CEO age, gender, tenure, ownership, and value of in-the-money unexercised exercisable options for acquirers' CEO. We control CEO age because an older CEO is likely to pursue better quality acquisitions with higher announcement returns while a younger CEO may announce aggressive acquisitions with lower returns and anticipate greater compensation from acquisitions (Yim, 2013). Levi, Li, and Zhang (2008) provide evidence that in bidder firms, female CEOs or female directors on the boards tend to result in smaller target cumulative abnormal announcement returns and reduce the bid premium. Management ownership is controlled because ownership of top management in acquirer firms is positively associated with acquirer returns (Lewellyn, Loderer, & Rosenfeld, 1985; You, Caves, Henry, & Smith, 1986). Amihud, Lev and Travlos (1990) further find that acquirers with lower CEO ownership are more likely to make equity offers, and these acquirers tend to have negative abnormal announcement returns. Value of in-the-money exercisable options is a proxy for the overconfidence of the CEO since CEO is expected not to exercise exercisable options only when they are confident of future stock prices. Malmendier and Tate (2008) argue that CEO's late option exercises arise only from overconfidence, and overconfident CEOs tend to overpay for targets and

undertake value-destroying mergers. The details of variables construction are included in the Appendix. All of them are measured at the end of the fiscal year preceding the announcement year.

IV Empirical Analyses

In this section, we present the descriptive statistics and conduct tests on the hypotheses. Main regressions are run on bidder and target abnormal announcement returns to detect evidence that acquisitions perform better when bidders with lower intangible capital acquire targets with higher intangible capital. Evidence on the combined returns for bidders and acquirers, labelled as acquisition synergies, is also provided to identify whether the market expects acquisitions involving intangible capital transfer to create aggregate value.

A Descriptive Statistics

Table 2 provides a statistical summary for the dependent and independent variables for the sample of 1,607 mergers[9]. In Panel A, the average (median) synergy over five trading days surrounding the merger announcement date (*Synergy5*) is 1.19% (0.78%). The positive figures for the combined returns of bidders and acquirers are consistent with the findings of Bradley et al. (1988), Moeller et al. (2004), and Wang and Xie (2009).

The mean (median) for *DINT* is 0.1563 (0.0029), suggesting a positive total intangible capital transfer from the target to the acquirer. The mean (median) for *DOFFBS* is 0.1880 (0.0072), that for *DKNOW* is 0.1090 (0.0000), and for *DORG* is 0.0770 (0.0060), suggesting positive off-balance-sheet intangible capital, knowledge capital, and organization capital transfers from the target to the acquirer. These preliminary statistics indicate that, on average, target firms tend to possess higher levels of intangible capital than their acquirers prior to mergers, regardless of whether it is knowledge capital, organization capital, or off-balance-sheet intangible capital.

In panels B and C of Table 2, the mean (median) for *ACQCAR5* is -1.39% (-0.99%) and that for *TGTCAR5* is 25.51% (20.56%). This is consistent with the existing evidence that suggests acquirers' shareholders suffer a slightly abnormal loss, and targets' shareholders experience

[9] We winsorize four proxies for intangible capital and firm characteristics (*Size*, *Tobin's Q*, *Leverage*, and *ROA*) at 99 and 1 percentiles of the distribution.

significant positive abnormal gains from M&As (Bradley et al., 1988; Lang et al., 1989; Masulis et al., 2007).

Table IV-1 Statistical Properties of Key Variables

This table presents descriptive statistics of key variables used in our study for 1,607 completed mergers over 1993-2014. In Panel A, Synergy5 is calculated based on five-day event window announcement returns. Intangible variables are extracted from Compustat database. Transfer of intangible variables are calculated by target intangible capital less acquirer intangible capital. Characteristics for acquirers and targets are presented in Panel B and Panel C. CEO characteristics for acquirers are also included in Panel B. The variables are estimated at the end of fiscal year before the announcement day. Dummy variables for deal characteristics are presented in Panel D. All variables are clearly defined in Appendix A.

Panel A: Descriptive Statistics-Combined								
Variable	Mean	STDEV	MIN	Q1	Median	Q3	MAX	N
Synergy5	1.19%	5.75%	-13.92%	-1.95%	0.78%	3.98%	18.87%	1,512
DINT	0.1563	0.5573	-1.2884	-0.0545	0.0029	0.2342	3.9724	1,607
DOFFBS	0.1880	0.5716	-1.1361	-0.0168	0.0072	0.2149	3.9982	1,607
DKNOW	0.1090	0.4341	-0.9103	0.0000	0.0000	0.0443	3.4686	1,607
DORG	0.0770	0.2523	-0.8261	-0.0157	0.0060	0.1321	1.5556	1,607
Panel B: Descriptive Statistics-Acquirers								
Variable	Mean	STDEV	MIN	Q1	Median	Q3	MAX	N
ACQCAR5 (%)	-1.37%	5.96%	-21.46%	-4.01%	-0.99%	1.59%	14.89%	1,607
Size	8.4780	1.7365	3.7074	7.2077	8.5336	9.8515	11.2089	1,607
Tobin's Q	2.1842	2.2568	0.5741	1.1360	1.5482	2.3854	38.0510	1,605
Leverage	0.1997	0.1570	0.0000	0.0774	0.1803	0.2863	1.0568	1,607
Return on Assets (ROA)	0.1258	0.0997	-0.8256	0.0358	0.1240	0.1928	0.4426	1,582
Delaware (Dummy)	0.5949	0.4911	0	0	1	1	1	1,607
Log CEO Age	4.0184	0.1219	3.5264	3.9512	4.0254	4.0943	4.4308	1,604
CEO Female	0.0100	0.0993	0.0000	0.0000	0.0000	0.0000	1.0000	1,607
Log CEO Tenure	4.0494	1.0968	0.0000	3.4657	4.2341	4.8363	6.3561	1,540
CEO Ownership	1.4884	5.0517	0.0000	0.0000	0.0000	0.4900	43.3000	1,607
Log, Value of Exercisable Options	7.0964	3.6250	0.0000	5.8889	8.2165	9.5350	13.9193	1,607
Panel C: Descriptive Statistics-Targets								
Variable	Mean	STDEV	MIN	Q1	Median	Q3	MAX	N
TGTCAR5 (%)	25.26%	23.75%	-14.89%	9.27%	20.56%	35.70%	115.09%	1,524
Size	5.8627	1.8490	-0.3079	4.5714	5.8832	7.0764	11.2089	1,607
Tobin's Q	1.9383	2.0332	0.4854	1.0572	1.3299	2.1191	32.6241	1,588
Leverage	0.2075	0.2646	0.0000	0.0217	0.1355	0.3207	3.2247	1,607
Return on Assets (ROA)	0.0493	0.1982	-1.0000	0.0205	0.0765	0.1459	0.4426	1,572
Panel D: Descriptive Statistics-Deal Characteristics								
Variable	Mean	STDEV	MIN	Q1	Median	Q3	MAX	N
Tender Offer	0.1910	0.3932	0	0	0	0	1	1,607
Cash Only	0.3727	0.4837	0	0	0	1	1	1,607
Merger of Equals	0.0075	0.0861	0	0	0	0	1	1,607
High Tech	0.2446	0.4300	0	0	0	0	1	1,607
Diversifying	0.2676	0.4428	0	0	0	1	1	1,607

Hostile	0.0012	0.0353	0	0	0	0	1	1,607
Relative Ratio	0.1663	0.2405	0.0003	0.0182	0.0652	0.2045	1.3482	1,586

In the sample investigated in our study, targets are on average much smaller in size than acquirers, with the mean (median) relative size ratio of target to the acquirer at 0.1663 (0.0652). Furthermore, the targets' average *ROA* (0.0493) is lower than acquirers' (0.1258). These figures echo the findings of Morck et al. (1990) that smaller and relatively underperforming firms are more likely to become targets. The average *Tobin's Q* for acquirers (2.1842) is higher than that for targets (1.9383), consistent with the evidence that acquirers are relatively overvalued compared to targets (Shleifer & Vishny, 2003). As presented in Panel D, 19.1% of the acquisitions in the sample are tender offers, 37.3% are cash-only deals, 0.8% are classified as mergers of equals, 24.5% are recognized as combinations of high-tech firms, 26.8% have targets and acquirers from different primary industries, and 0.1% are hostile takeovers.

The pairwise correlations between dependent variables and independent variables are presented in Table 3. The proxies for intangible capital transfer from targets to acquirers, *DINT*, *DOFFBS*, *DKNOW*, and *DORG*, are positively correlated with *ACQCAR5* and *TGTCAR5*. *DINT*, *DOFFBS*, and *DORG* are also positively correlated with *Synergy5*. Surprisingly, the relationship between *DKNOW* and *Synergy5* appears to be slightly negative. In general, these correlations provide tentative initial support for the prediction that M&As involving intangible capital transfer from the target to the acquirer is likely to enhance bidder shareholders' benefits.

B Main Results

To test our hypotheses, we regress proxies for intangible capital transfer on the proxies for deal performance, controlling for all bidders and targets traits, bidders' CEO characteristics, and deal characteristics described in Section III. B.

Table IV-2 Pairwise Correlation Coefficients

This table presents the correlations for dependent variables, key test variables, and control variables for a sample of 1,607 completed mergers in U.S. from 1993 to 2014. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	acqcar5	1													
(2)	tgtcar5	0.101***	1												
(3)	synergy5	0.793***	0.279***	1											
(4)	dint	0.070***	0.120***	0.011	1										
(5)	dknow	0.038	0.121***	-0.008	0.850***	1									
(6)	dorg	0.126***	0.083***	0.068***	0.647***	0.332***	1								
(7)	doffbs	0.084***	0.131***	0.023	0.950***	0.888***	0.692***	1							
(8)	alogassets	0.087***	0.010	-0.095***	-0.088***	-0.075***	-0.079***	-0.094***	1						
(9)	atobinsq	-0.045*	0.032	-0.073***	0.060**	0.064**	0.014	0.055**	-0.197***	1					
(10)	aleverage	0.061**	-0.057**	0.130***	-0.035	-0.029	-0.015	-0.037	0.146***	-0.214***	1				
(11)	aroa	0.121***	0.095***	0.081***	-0.016	-0.027	0.035	-0.011	-0.198***	0.394***	-0.075***	1			
(12)	tlogassets	-0.088***	-0.170***	0.041	-0.366***	-0.338***	-0.306***	-0.402***	0.526***	-0.224***	0.157***	-0.253***	1		
(13)	ttobinsq	-0.059**	-0.019	-0.064**	0.230***	0.284***	0.103***	0.257***	-0.076***	0.473***	-0.105***	0.233***	-0.259***	1	
(14)	tleverage	0.015	-0.005	0.039	0.131***	0.148***	0.019	0.113***	0.019	-0.124***	0.262***	-0.009	0.107***	0.129***	1
(15)	troa	-0.017	-0.125***	0.092***	-0.516***	-0.629***	-0.138***	-0.533***	0.014	-0.080***	0.093***	0.157***	0.303***	-0.149***	-0.084***
(16)	tenderoffer	0.116***	0.186***	0.106***	0.084***	0.093***	0.069***	0.095***	-0.075***	0.040	-0.039	0.211***	-0.168***	0.033	-0.016
(17)	cashonly	0.217***	0.234***	0.157***	0.139***	0.114***	0.189***	0.169***	0.052**	0.011	-0.028	0.229***	-0.248***	0.034	-0.031
(18)	moe	0.008	-0.074***	0.01	-0.024	-0.022	-0.044*	-0.036	-0.008	-0.036	0.056**	-0.044*	0.109***	-0.027	0.052**
(19)	high_tech	-0.076***	0.043*	-0.090***	0.144***	0.110***	0.158***	0.148***	-0.216***	0.275***	-0.245***	0.201***	-0.300***	0.209***	-0.184***
(20)	diversifying	0.052**	0.091***	0.007	0.045*	0.018	0.091***	0.056**	0.005	0.056**	0.037	0.169***	-0.218***	0.083***	0.008
(21)	hostile	0.014	0.027	0.072***	-0.025	-0.019	-0.023	-0.025	0.012	-0.016	0.000	0.004	0.044*	-0.012	0.015
(22)	relativew	-0.189***	-0.191***	0.180***	-0.158***	-0.135***	-0.138***	-0.165***	-0.263***	-0.100***	0.147***	-0.035	0.350***	-0.001	0.082***
(23)	adelaware	0.009	0.004	0.051**	0.067***	0.055**	0.090***	0.087***	-0.147***	0.078***	-0.003	0.097***	-0.087***	0.092***	0.025
(24)	log CEO age	0.062**	-0.034	-0.013	-0.047*	-0.028	-0.034	-0.036	0.276***	-0.135***	0.069***	-0.027	0.149***	-0.100***	0.04
(25)	CEO female	-0.005	0.000	0.012	-0.014	-0.013	-0.03	-0.024	-0.014	0.013	0.017	0.031	0.027	0.006	0.025
(26)	log CEO tenure	0.038	-0.040	-0.029	-0.004	0.001	0.051**	0.013	0.094***	-0.029	0.026	-0.072***	0.014	-0.075***	-0.053**
(27)	ceo_own	-0.014	-0.058**	-0.054**	0.066***	0.038	0.091***	0.074***	-0.044*	0.057**	-0.055**	0.043*	-0.067***	0.064**	0.040

(28)	Log, value of exercisable options	0.056**	0.003	-0.055**	-0.029	-0.002	0.023	0.000	0.227***	0.140***	0.049**	0.137***	0.019	0.121***	-0.034
	Variables	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
(15)	troa	1													
(16)	tenderoffer	-0.053**	1												
(17)	cashonly	-0.051**	0.454***	1											
(18)	moe	0.012	-0.042*	-0.067***	1										
(19)	high_tech	-0.072***	0.044*	0.115***	-0.033	1									
(20)	diversifying	0.051**	0.150***	0.171***	-0.02	0.039	1								
(21)	hostile	0.009	0.073***	0.046*	-0.003	-0.02	0.019	1							
(22)	relativew	0.215***	-0.097***	-0.200***	0.254***	-0.023	-0.113***	0.044*	1						
(23)	adelaware	0.017	0.072***	0.062**	0.013	0.160***	0.032	-0.007	0.093***	1					
(24)	log CEO age	0.054**	0.068***	0.079***	-0.037	-0.137***	0.081***	0.014	-0.092***	-0.016	1				
(25)	CEO female	0.008	-0.001	0.013	-0.009	-0.042*	0.010	-0.004	0.024	-0.007	-0.024	1			
(26)	log CEO tenure	0.011	-0.029	-0.011	-0.014	0.021	-0.006	0.004	-0.093***	-0.024	0.296***	0.008	1		
(27)	ceo_own	0.016	-0.003	0.032	-0.020	0.031	0.060**	-0.009	-0.038	0.075***	0.138***	-0.014	0.213***	1	
(28)	Log, value of exercisable options	-0.008	-0.012	0.068***	-0.060**	0.082***	0.026	-0.027	-0.196***	0.078***	0.049**	-0.001	0.196***	-0.135***	1

$$\text{Deal\_Performance}_{i,t} = \beta_0 + \beta_1 transfer_{i,t-1} + \beta_2 acquirer\_size_{i,t-1} + \beta_3 acquirer\_tobinsq_{i,t-1} + \beta_4 acquirer\_leverage_{i,t-1} + \beta_5 acquirer\_ROA_{i,t-1} + \beta_6 acquirer\_Delaware_{i,t-1} + \beta_7 target\_size_{i,t-1} + \beta_8 target\_tobinsq_{i,t-1} + \beta_9 target\_leverage_{i,t-1} + \beta_{10} target\_ROA_{i,t-1} + \beta_{11} acquirer\_CEOage_{i,t-1} + \beta_{12} acquirer\_CEOgender_{i,t-1} + \beta_{13} acquirer\_CEOtenure_{i,t-1} + \beta_{14} acquirer\_CEOownership_{i,t-1} + \beta_{15} acquirer\_CEOexercisableoption_{i,t-1} + \beta_{16} tenderoffer_{i,t-1} + \beta_{17} cashonly_{i,t-1} + \beta_{18} mergersofequal_{i,t-1} + \beta_{19} hightech_{i,t-1} + \beta_{20} diversifying_{i,t-1} + \beta_{21} hostile_{i,t-1} + \beta_{22} relativesize_{i,t-1} + year\_FE + industry\_FE + \varepsilon_{i,t} \quad \text{(Equation IV-1)}$$

Where the dependent variables are the acquisition abnormal announcement returns for i) bidders, ii) targets and iii) both bidders and targets together (*Synergy5*); the test variables $transfer_{i,t-1}$ refer to *DINT*, *DOFFBS*, *DKNOW*, and *DORG*; the control variables include acquirer and target firms' characteristics, deal characteristics, and acquirers' CEO characteristics. In all specifications, we use OLS regressions with cluster-robust (by firm) standard errors on acquirer's cumulative abnormal announcement returns. We also include year fixed effect and industry fixed effects in these tests.

Intangible capital transfer and acquirer takeover abnormal announcement returns

Firstly, tests are conducted to explore the first hypothesis that acquirers' shareholders benefit from M&As involving intangible capital transfer from targets to bidders by regressing proxies for intangible capital transfer along with a set of control variables on *ACQCAR5*. The regression results are presented in Table 4.

Column 1 shows the effect of total intangible capital transfer (*DINT*) on acquirer five-day cumulative abnormal announcement returns (*ACQCAR5*). Total intangible capital includes intangible capital both on and off the balance sheet. The estimated coefficient on *DINT* is 0.0084, which is significant at the 5% level, indicating that the market reacts positively to acquisition announcements involving the total intangible capital transfer. Based on this coefficient estimate, a one standard deviation (approximately 0.5573) increase in *DINT* leads to a 47 basis points (bps)

increase in *ACQCAR5*. Turn to other regressors, bidder's profitability and managerial performance proxied by *ROA* are found to be significantly positively associated with *ACQCAR5*, consistent with the findings of Maloney, McCormick and Mitchell (1993). In line with the conclusions of Bhagat et al. (2005) and Wang and Xie (2009), we find that stock market valuation of targets, as measured by the target's *Tobin's Q*, lowers the *ACQCAR5*, and acquisitions purely financed by cash tend to increase *ACQCAR5*. The relative size of the target to acquirer has a significant positive effect on *ACQCAR5*, consistent with the finding of Asquith et al. (1983). These results hold after including the bidders' CEO characteristics variables, though their coefficients are not significant. Bidder CEO age, the CEO gender of female, and CEO ownership are negatively associated with bidder abnormal announcement returns. CEO's tenure and the value of exercisable options are positively related to bidder returns.

The proxy for total intangible capital transfer *DINT* includes the transfer of both off-balance-sheet and on-balance-sheet intangible capital. The next step is to investigate the transfer effect of off-balance-sheet intangible capital in isolation. We repeat the regressions replacing test variables to off-balance-sheet intangible capital transfer (*DOFFBS*) and its effect on *ACQCAR5* is displayed in column 2. The off-balance-sheet intangible capital transfer has a significant positive effect on the acquirer abnormal announcement returns. The estimated coefficient 0.0092 of *DOFFBS* (significant at the 5% level) suggests that a one standard deviation (0.5716) increase in *DOFFBS* increases *ACQCAR5* by approximately 53 bps.

In columns 3 and 4, two components of off-balance-sheet intangible capital transfer, namely knowledge capital transfer (*DKNOW*) and organization capital transfer (*DORG*), are used as test variables. In column 3, the estimated coefficient 0.0072 of *DKNOW* is positive but not statistically significant, indicating that knowledge capital transfer from targets to acquirers is not significantly associated with *ACQCAR5*. In column 4, the estimated coefficient 0.0206 of *DORG* is positive (significant at the 1% level), suggesting that organization capital transfer has a significant positive effect on *ACQCAR5*. This finding is consistent with the argument of Li et al.'s (2018) that the gap in organization capital between acquirers and targets drives acquirer returns. The coefficient of *DORG* suggests that a one standard deviation (0.2523) increase in *DORG* increases *ACQCAR5* by approximately 52 bps. The coefficients of control variables for the two regressions are similar in sign and magnitude.

Table IV-3 Intangible Capital Transfer and Acquirer Takeover Abnormal Announcement Returns

This table presents results for regression of acquirers' five-day event window cumulative abnormal returns around announcement day on test variables and control variables. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. All regressions control for year-effect and industry-effect. The sample consists of 1,607 complete U.S. mergers and acquisitions from 1993 to 2014. Exclusive of missing value for some variables, 1,476 observations remain. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

	(1) ACQCAR5	(2) ACQCAR5	(3) ACQCAR5	(4) ACQCAR5
Model				
DINT	0.0084**			
	(2.218)			
DOFFBS		0.0092**		
		(2.366)		
DKNOW			0.0072	
			(1.378)	
DORG				0.0206***
				(2.739)
Acquirer Characteristics				
Size	0.0010	0.0009	0.0012	0.0008
	(0.595)	(0.559)	(0.711)	(0.485)
Tobin's Q	-0.0006	-0.0005	-0.0005	-0.0006
	(-0.268)	(-0.232)	(-0.254)	(-0.289)
Leverage	0.0269	0.0270	0.0268	0.0275*
	(1.639)	(1.641)	(1.627)	(1.678)
Return on Assets (ROA)	0.0924***	0.0936***	0.0906***	0.0930***
	(3.173)	(3.209)	(3.101)	(3.203)
Delaware	0.0046	0.0043	0.0047	0.0044
	(1.267)	(1.188)	(1.295)	(1.214)
Log CEO Age	-0.0185	-0.0187	-0.0197	-0.0174
	(-1.181)	(-1.189)	(-1.249)	(-1.112)
CEO Female	-0.0098	-0.0092	-0.0104	-0.0087
	(-0.345)	(-0.325)	(-0.363)	(-0.305)
Log CEO Tenure	0.0011	0.0010	0.0011	0.0009
	(0.592)	(0.568)	(0.593)	(0.493)
CEO Ownership	-0.0001	-0.0001	-0.0000	-0.0001
	(-0.108)	(-0.156)	(-0.076)	(-0.180)
Log, Value of Exercisable Options	0.0004	0.0003	0.0003	0.0003

	(0.725)	(0.626)	(0.655)	(0.588)
Target Characteristics				
Size	-0.0022	-0.0020	-0.0026*	-0.0020
	(-1.405)	(-1.279)	(-1.680)	(-1.230)
Tobin's Q	-0.0026**	-0.0027**	-0.0026**	-0.0025*
	(-2.052)	(-2.092)	(-1.976)	(-1.946)
Leverage	0.0030	0.0035	0.0039	0.0044
	(0.411)	(0.475)	(0.522)	(0.609)
Return on Assets (ROA)	-0.0029	-0.0018	-0.0048	-0.0107
	(-0.224)	(-0.134)	(-0.341)	(-0.910)
Deal Characteristics				
Tender Offer	0.0042	0.0042	0.0040	0.0043
	(0.967)	(0.982)	(0.930)	(1.005)
Cash Only	0.0173***	0.0172***	0.0176***	0.0167***
	(4.325)	(4.331)	(4.396)	(4.217)
Merger of Equals	0.0463**	0.0468**	0.0463**	0.0471**
	(2.050)	(2.088)	(2.043)	(2.116)
High Tech	-0.0081	-0.0075	-0.0076	-0.0074
	(-1.237)	(-1.147)	(-1.162)	(-1.132)
Diversifying	0.0012	0.0013	0.0011	0.0010
	(0.305)	(0.322)	(0.274)	(0.255)
Hostile	0.0339	0.0341	0.0332	0.0335
	(1.529)	(1.508)	(1.468)	(1.467)
Relative Ratio	-0.0439***	-0.0442***	-0.0439***	-0.0438***
	(-3.573)	(-3.596)	(-3.538)	(-3.590)
Constant	0.0416	0.0413	0.0481	0.0368
	(0.650)	(0.645)	(0.749)	(0.580)
Observations	1,476	1,476	1,476	1,476
Adjusted R-squared	0.132	0.133	0.130	0.134
Other Effects				
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes

We notice that except knowledge capital transfer, other intangible capital transfer proxies are significantly associated with acquirer abnormal announcement returns. This finding corresponds to the degree of transparency for knowledge capital and organization capital discussed in the literature review. The accounting disclosure of separately reported items of R&D expenses in firms' income statements and increasing media and analytical coverage of R&D intensive firms has improved the transparency for knowledge capital (Lev, 2000; Chan et al., 2001). This to some

extent mitigates the information asymmetry with respect to knowledge capital. Moreover, the proportion of knowledge capital is much smaller than that of organization capital. In the sample used by Peters and Taylor (2017), knowledge capital only constitutes an average of 24% of total intangibles. This small proportion may lead to the less significant contributions to takeover returns. In contrast, organization capital is more tacit as the investment in it is not reported separately in financial statement and the efforts of industry attention and capital research are not sufficient. Therefore, information asymmetry with respect to organization capital is more severe, and the investment environment is consequently harsher.

Overall, the above analyses provide strong evidence for the first hypothesis that bidders experience incremental abnormal announcement returns when intangible capital transfer from targets to bidders increases. In particular, acquirer shareholders benefit more from organization capital transfer than from knowledge capital transfer.

Intangible capital transfer and target takeover abnormal announcement returns

Having identified that acquirers with relatively low intangible capital have high abnormal announcement returns when acquiring high-intangibles targets, we test whether target firms also have high abnormal announcement returns in such acquisitions. A similar set of regressions are estimated to investigate the relationship between intangible capital transfer and target shareholders' returns during the announcement period. The dependent variable to measure the target's performance is the target cumulative abnormal announcement returns in the five-day event window, *TGTCAR5*. All explanatory variables remain the same as those used in the tests for the acquirer cumulative abnormal announcement returns.

Table 5 shows the regression results for target abnormal announcement returns. Columns 1 to 4 present the results for *DINT*, *DOFFBS*, *DKNOW*, and *DORG*, respectively. The coefficient estimates for *DINT*, *DOFFBS*, and *DKNOW* are positive (0.0133, 0.0126, and 0.0422, respectively) and the coefficient of *DORG* is negative (-0.0133). However, none of the coefficient estimates for the transfer proxies across the four models is significant, indicating that takeovers with intangible capital transfer from targets to acquirers do not create significant value for target shareholders. The negative figure produced by the fourth model may imply that value could flow away from targets

when organization assets are transferred to bidders, however, the coefficient is not significantly different from zero.

Table IV-4 Intangible Capital Transfer and Targets Takeover Abnormal Announcement Returns

This table presents results for regression of targets' five-day event window cumulative abnormal returns around announcement day on test variables and control variables. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. All regressions control for year-effect and industry-effect. The sample consists of 1,607 complete U.S. mergers and acquisitions from 1993 to 2014. Exclusive of missing value for some variables, 1,407 observations remain. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

	(1) TGTCAR5	(2) TGTCAR5	(3) TGTCAR5	(4) TGTCAR5
Model				
DINT	0.0133			
	(0.588)			
DOFFBS		0.0126		
		(0.538)		
DKNOW			0.0422	
			(0.992)	
DORG				-0.0133
				(-0.330)
Acquirer Characteristics				
Size	0.0168**	0.0168**	0.0169**	0.0173**
	(2.224)	(2.227)	(2.290)	(2.272)
Tobin's Q	0.0008	0.0009	0.0014	0.0007
	(0.162)	(0.178)	(0.268)	(0.135)
Leverage	-0.0445	-0.0443	-0.0481	-0.0418
	(-0.881)	(-0.878)	(-0.962)	(-0.823)
Return on Assets (ROA)	0.0995	0.1013	0.0967	0.0964
	(0.896)	(0.915)	(0.869)	(0.850)
Delaware	-0.0170	-0.0173	-0.0184	-0.0161
	(-1.100)	(-1.119)	(-1.205)	(-1.027)
Log CEO Age	-0.1188	-0.1198	-0.1210	-0.1243
	(-1.574)	(-1.582)	(-1.607)	(-1.647)
CEO Female	0.0092	0.0097	0.0109	0.0062

	(0.111)	(0.117)	(0.134)	(0.073)
Log CEO Tenure	-0.0139	-0.0139	-0.0140	-0.0136
	(-1.578)	(-1.579)	(-1.590)	(-1.559)
CEO Ownership	-0.0025*	-0.0025*	-0.0025*	-0.0024*
	(-1.802)	(-1.817)	(-1.830)	(-1.716)
Log, Value of Exercisable Options	-0.0005	-0.0006	-0.0006	-0.0006
	(-0.238)	(-0.275)	(-0.269)	(-0.267)
Target Characteristics				
Size	-0.0157**	-0.0156*	-0.0151*	-0.0170**
	(-1.976)	(-1.952)	(-1.942)	(-2.114)
Tobin's Q	-0.0096**	-0.0096**	-0.0104**	-0.0093**
	(-2.120)	(-2.148)	(-2.263)	(-2.031)
Leverage	0.0826*	0.0837*	0.0793*	0.0860*
	(1.723)	(1.771)	(1.672)	(1.834)
Return on Assets (ROA)	-0.1164*	-0.1166*	-0.0868	-0.1289*
	(-1.672)	(-1.669)	(-1.257)	(-1.702)
Deal Characteristics				
Tender Offer	0.0529**	0.0530**	0.0530**	0.0525**
	(2.165)	(2.170)	(2.185)	(2.154)
Cash Only	0.0427**	0.0426**	0.0431**	0.0441**
	(2.079)	(2.070)	(2.093)	(2.140)
Merger of Equals	-0.0792	-0.0787	-0.0785	-0.0797
	(-1.494)	(-1.487)	(-1.494)	(-1.499)
High Tech	-0.0262	-0.0254	-0.0262	-0.0252
	(-1.015)	(-0.984)	(-1.012)	(-0.980)
Diversifying	0.0130	0.0130	0.0141	0.0121
	(0.721)	(0.719)	(0.794)	(0.659)
Hostile	0.1732***	0.1730***	0.1765***	0.1687***
	(3.056)	(3.020)	(3.069)	(2.944)
Relative Ratio	-0.0836**	-0.0840**	-0.0845**	-0.0843**
	(-2.119)	(-2.130)	(-2.160)	(-2.141)
Constant	0.7154**	0.7187**	0.7191**	0.7437**
	(2.382)	(2.377)	(2.385)	(2.462)
Observations	1,407	1,407	1,407	1,407
Adjusted R-squared	0.116	0.116	0.118	0.116
Other Effects				
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes

Most of the parameter estimates for firm and deal characteristics show signs consistent with the results of Wang and Xie (2009). In particular, bidder size is positively associated with target

abnormal announcement returns while target size has a negative effect. *Tobin's Q* and *ROA* of targets reduce their abnormal announcement returns. Tender offers, hostile bids, and cash payments improve the returns, while the returns are cut off by the relative size of target to acquirer. With respect to CEO variables, the proxies for bidders' CEO age, tenure, ownership, and the value of exercisable options are all negatively associated with target abnormal announcement returns. Female CEOs of the bidders are insignificantly positively related to the target abnormal announcement returns. There is a positive but not significant relationship between the target abnormal announcement returns and bidder's CEO gender of female.

In summary, the evidence supports the argument that intangible capital transfer from target firms to acquirers does not make a significant contribution to the target shareholders' abnormal announcement returns.

Intangible capital transfer and takeover synergy

The above tests provide evidence to support the hypothesis that takeovers with intangible capital transfers from targets to bidders create significant value for bidders' shareholders. We also find that intangible capital transfers do not provide significant benefit to targets' shareholders. This section focuses on the effect of intangible capital transfer on the combined abnormal announcement returns of target and acquirer and will examine the third hypothesis that acquisitions create value (not only transfer value between parties) if intangible capital is transferred from targets to bidders. If additional value emerges following the transactions, takeovers involving intangible transfer from targets to bidders create "new" value and benefit for the economy.

Following Bradley et al. (1988), synergy (*Synergy5*) is used as a proxy for the combined returns of acquirers and targets from acquisitions. *Synergy5* is the weighted average of *ACQCAR5* and *TGTCAR5*, where their weights are the market values of acquirers and targets as a percentage of the sum of their market values, respectively. We regress *Synergy5* on all test and control variables applied in preceding sections and present the results in Table 6. The coefficient estimates show that intangible capital transfers from targets to bidders have a significant positive effect on acquisition synergies. Specifically, the coefficient estimate of *DINT* on *synergy5* (0.0096, significant at the 5% level) suggests that a one standard deviation (0.5573) increase in *DINT* increases *synergy5* by approximately 54 bps. The coefficient estimates for *DOFFBS*, *DKNOW*,

and *DORG* are 0.0099, 0.0125, and 0.0156, respectively, and all are significant at the 5% level. In light of the economic significance, we find that ceteris paribus, the combined returns increase by 57 bps, 54 bps, and 39 bps with a one standard deviation increase in *DOFFBS*, *DKNOW*, and *DORG* respectively. It is notable that the economic effect of off-balance-sheet intangible capital transfer on combined returns is very similar to that of the total intangible capital transfer, and surprisingly the knowledge capital transfer has a greater overall economic effect than the transfer of organization capital.

Table IV-5 Intangible Capital Transfer and Takeover Synergies

This table presents results for regression of synergy calculated using five-day event window announcement returns around announcement day on test variables and control variables. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. All regressions control for year-effect and industry-effect. The sample consists of 1,607 complete U.S. mergers and acquisitions from 1993 to 2014. Exclusive of missing value for some variables, 1,486 observations remain. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

	(1) Synergy5	(2) Synergy5	(3) Synergy5	(4) Synergy5
Model				
DINT	0.0096**			
	(2.234)			
DOFFBS		0.0099**		
		(2.336)		
DKNOW			0.0125**	
			(2.093)	
DORG				0.0156*
				(1.814)
Acquirer Characteristics				
Size	-0.0032*	-0.0032*	-0.0030*	-0.0032*
	(-1.773)	(-1.780)	(-1.685)	(-1.779)
Tobin's Q	-0.0005	-0.0004	-0.0004	-0.0006
	(-0.248)	(-0.213)	(-0.192)	(-0.286)
Leverage	0.0436**	0.0436**	0.0434**	0.0443**
	(2.346)	(2.350)	(2.341)	(2.388)
Return on Assets (ROA)	0.0420	0.0434	0.0409	0.0446

	(1.288)	(1.335)	(1.245)	(1.371)
Delaware	0.0019	0.0016	0.0018	0.0020
	(0.542)	(0.458)	(0.498)	(0.564)
Log CEO Age	-0.0268*	-0.0273*	-0.0290*	-0.0272*
	(-1.697)	(-1.728)	(-1.829)	(-1.726)
CEO Female	-0.0066	-0.0061	-0.0069	-0.0064
	(-0.246)	(-0.228)	(-0.256)	(-0.234)
Log CEO Tenure	0.0011	0.0011	0.0012	0.0011
	(0.581)	(0.562)	(0.603)	(0.574)
CEO Ownership	-0.0005	-0.0005	-0.0004	-0.0005
	(-0.885)	(-0.937)	(-0.861)	(-0.930)
Log, Value of Exercisable Options	-0.0002	-0.0003	-0.0003	-0.0003
	(-0.450)	(-0.554)	(-0.541)	(-0.568)
Target Characteristics				
Size	0.0020	0.0022	0.0018	0.0020
	(1.100)	(1.176)	(1.024)	(1.061)
Tobin's Q	-0.0024	-0.0025	-0.0026	-0.0023
	(-1.477)	(-1.503)	(-1.469)	(-1.413)
Leverage	-0.0067	-0.0061	-0.0063	-0.0045
	(-0.817)	(-0.735)	(-0.753)	(-0.543)
Return on Assets (ROA)	0.0057	0.0064	0.0089	-0.0042
	(0.377)	(0.423)	(0.551)	(-0.293)
Deal Characteristics				
Tender Offer	0.0068	0.0069	0.0068	0.0069
	(1.373)	(1.394)	(1.363)	(1.383)
Cash Only	0.0215***	0.0214***	0.0219***	0.0212***
	(4.956)	(4.959)	(5.082)	(4.854)
Merger of Equals	-0.0251	-0.0246	-0.0249	-0.0247
	(-0.951)	(-0.945)	(-0.948)	(-0.950)
High Tech	-0.0157**	-0.0151**	-0.0152**	-0.0148**
	(-2.238)	(-2.152)	(-2.171)	(-2.119)
Diversifying	0.0005	0.0006	0.0005	0.0002
	(0.129)	(0.134)	(0.129)	(0.046)
Hostile	0.0900**	0.0900**	0.0895**	0.0890**
	(2.035)	(2.013)	(2.004)	(1.975)
Relative Ratio	0.0432**	0.0429**	0.0428**	0.0436**
	(2.548)	(2.532)	(2.528)	(2.570)
Constant	0.1140*	0.1153*	0.1229*	0.1158*
	(1.760)	(1.778)	(1.893)	(1.786)
Observations	1,407	1,407	1,407	1,407
Adjusted R-squared	0.144	0.144	0.143	0.142
Other Effects				
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes

Turn to control variables, both the magnitude and statistical significance of the coefficients estimates are fairly stable across the four models shown in Table 6. Bidders' size, proxied by *Size*, is significantly negatively associated with *Synergy5*, mirroring the findings of Moeller et al. (2004) and Wang and Xie (2009). The *Relative Ratio* is still significantly related to the combined returns after controlling for bidders' size. *Tobin's Q* of bidders and targets are not significantly related to the total value improvement, following the results of Wang and Xie (2009). In contrast, Bhagat et al. (2005) find that bidder's *Tobin's Q* is negatively associated with synergy. Although Bradley et al. (1988) provide evidence that tender offers increase the combined value of targets and bidders by an average of 7.4%, in our study, an insignificant positive effect towards tender offers is observed. Cash-only deals provide some benefit for both shareholders, but the combination of high-tech firms tend to reduce this benefit. Combined returns are higher for hostile takeovers, consistent with the finding of Bhagat et al. (2005).

In general, the positive effects of the intangible capital transfer on the synergies support the prediction that acquisitions involving intangible capital transfers from targets to bidders create additional value. Intangible capital transfers not only contribute to acquirer abnormal announcement returns but also positively affect the value of the combined firms. We interpret this as evidence that intangible capital transfers from targets to bidders do not necessarily transfer value from the targets to bidders' shareholders. In fact, the market perceives such transfers as creating new value, for example by placing intangible capital under the management of a firm in which it can be better utilized. Related studies have provided some evidence for this value-creation argument. Phillips and Zhdanov (2012) argue that post-merger, the joint entity is able to apply acquired innovation to a wider product range, thus generating extra earnings. Cassiman and Veugelers (2006) posit that the existence of complementarity in knowledge capital between targets and acquirers creates competitive edges after the transactions, especially when the knowledge capital is protected. Intangible capital transfers can also catalyze innovation activities and enhance the outcomes. Sun (2014) finds that technology-driven takeovers in China increase the patent applications growth ratio from 1.649 to 10.664.

C. Additional Analyses

So far, the results of the main regressions suggest that the increase in intangible capital transfer from targets to acquirers improves the deals, and in particular improves the acquirer abnormal announcement returns and overall synergies. In this section, several mechanisms that may affect the performance of takeovers are explored in more detail.

Product-market competition

Shleifer and Vishny (1997) argue that product-market competition is an important force for improving economic efficiency. In more competitive industries, firms' product-market margins are thin, and any missteps made by managers would be exploited by competitors very quickly. As a result, firms are forced to lower costs and improve corporate governance so that managers are less likely to make bad decisions. The conclusions are mixed in the literature focusing on the relationship between innovations and product-market competition. Fulghieri and Sevilir (2011) find that firms' innovation activities are reduced with the decreases in competition. However, Dasgupta and Stiglitz (1980) report a negative relationship between competition and innovation and Aghion et al. (2002) suggest the relationship is U-shaped.

The first question to investigate is whether the performance of M&As between high-intangibles targets and low-intangibles acquirers can be explained by acquirer product-market competition. The product-market competitiveness of an industry is captured using the Herfindahl-Hirschman Index (*HHI*), which is estimated as the sum of the squared market shares of the firms in each Fama-French 48 industry. Market share is calculated as firm sales divided by industry sales. A lower *HHI* value indicates lower industry concentration and more competitive product markets.

Table 7 presents the regression results after controlling for acquirers' *HHI*. In Panel A, both the magnitude and statistical significance of the coefficient estimates for the intangible capital transfer proxies remain practically unchanged. It is worth noting that the competitive industry indicator *HHI* has a significant negative coefficient on *ACQCAR5* (-0.0307 in column 1, significant at the 5% level, similar magnitude and significance in other columns), indicating that acquirers' shareholders receive lower returns when they are in more concentrated industries. In panels B and C, the effects of intangible capital transfer hold when *TGTCAR5* and *Synergy5* are used as the

dependent variable, however, the coefficient estimates for *HHI* are statistically insignificant in these regressions.

Table IV-6 Intangible Capital Transfer and Product-market Competitive

This table shows results for regressions of key test variables and control variables on five-days bidder's abnormal announcement returns, target's abnormal announcement returns, and acquisition synergy. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. Herfindahl index (*HHI*) proxied for acquirers' product-market competitive is included. All regressions control for year-effect and industry-effect. The sample consists of 1,607 complete U.S. mergers and acquisitions from 1993 to 2014. For the sake of simplify, the results for control variables are not reported. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

Panel A: Acquirer Side				
	(1)	(2)	(3)	(4)
	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5
Model				
DINT	0.0085**			
	(2.231)			
DOFFBS		0.0093**		
		(2.392)		
DKNOW			0.0018	
			(0.965)	
DORG				0.0208***
				(2.800)
HHI	-0.0307*	-0.0310*	-0.0295*	-0.0301*
	(-1.815)	(-1.826)	(-1.747)	(-1.789)
Control Variables	Yes	Yes	Yes	Yes
Constant	0.0476	0.0473	0.0571	0.0431
	(0.757)	(0.752)	(0.904)	(0.691)
Observations	1,486	1,486	1,486	1,486
Adjusted R-squared	0.132	0.132	0.128	0.134
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes
Panel B: Target Side				

	(5) TGTCAR5	(6) TGTCAR5	(7) TGTCAR5	(8) TGTCAR5
Model				
DINT	0.0132			
	(0.590)			
DOFFBS		0.0102		
		(0.439)		
DKNOW			-0.0103	
			(-0.337)	
DORG				-0.0183
				(-0.453)
HHI	0.0100	0.0103	0.0132	0.0132
	(0.134)	(0.138)	(0.177)	(0.176)
Control Variables	Yes	Yes	Yes	Yes
Constant	0.7349**	0.7406**	0.7583**	0.7652**
	(2.486)	(2.489)	(2.571)	(2.572)
Observations	1,419	1,419	1,419	1,419
Adjusted R-squared	0.116	0.115	0.115	0.115
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes
Panel C: Combined				
	(9) Synergy5	(10) Synergy5	(11) Synergy5	(12) Synergy5
Model				
DINT	0.0096**			
	(2.255)			
DOFFBS		0.0097**		
		(2.291)		
DKNOW			0.0062	
			(1.499)	
DORG				0.0157*
				(1.837)
HHI	-0.0057	-0.0059	-0.0047	-0.0050
	(-0.317)	(-0.330)	(-0.263)	(-0.278)
Control Variables	Yes	Yes	Yes	Yes
Constant	0.1105*	0.1120*	0.1197*	0.1123*
	(1.746)	(1.766)	(1.886)	(1.772)
Observations	1,419	1,419	1,419	1,419
Adjusted R-squared	0.146	0.146	0.143	0.144
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes

Acquirer Clustering	Yes	Yes	Yes	Yes

A dummy variable is also constructed for product-market competition, denoted as *Competitive*, where *Competitive* equals to 1 if *HHI* is less than 0.15 and equals 0 otherwise[10]. Repeating the tests on *ACQCAR5* on competitive and non-competitive subsamples in Table 8, we find that the effects of intangible capital transfer hold for the competitive group but not for the non-competitive group. One explanation for this finding could be that firms in competitive industries need to acquire more intangible capital to maintain their competitive edge. Therefore, the effect of intangible capital transfer is more significant and positive for acquirers in the competitive subsample.

Table IV-7 Subsample Test: Check Product-Market Competitive

This table shows results for regressions of key test variables and control variables on five-days bidder's abnormal announcement returns. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. Herfindahl index (*HHI*) proxied for acquirers' product-market competitive is included. Competitive dummy is equal 1 for *HHI* greater than 0.15, 0 otherwise. All regressions control for year-effect and industry-effect. The sample consists of 1,148 complete U.S. competitive mergers and acquisitions from 1993 to 2014. For the sake of simplify, the results for control variables are not reported. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

	Competitive				**Non-competitive**			
Acquirer Side								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5
Model								
DINT	0.0095**				0.0036			
	(2.348)				(0.323)			
DOFFBS		0.0096**				0.0028		

[10] The competitive industry cut-off of 0.15 is based on the classification in the U.S. Department of Justice, which consider markets with *HHI* lower than 0.15 as unconcentrated markets, those with *HHI* between 0.15 and 0.25 as moderately concentrated, and those with *HHI* higher than 0.25 as highly concentrated markets. See, https://www.justice.gov/atr/horizontal-merger-guidelines-08192010#5c

		(2.394)				(0.244)		
DKNOW			0.0105**				-0.0132	
			(2.101)				(-0.586)	
DORG				0.0180**				0.0205
				(2.152)				(1.286)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.1000	0.1000	0.1079	0.0980	0.0958	0.0965	0.1130	0.0795
	(1.287)	(1.289)	(1.389)	(1.267)	(0.726)	(0.720)	(0.836)	(0.607)
Observations	1,148	1,148	1,148	1,148	328	328	328	328
Adjusted R-squared	0.160	0.160	0.159	0.160	0.163	0.163	0.165	0.168
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Diversification effect

There is mixed evidence on the effect of diversification. Morck et al. (1990) and Bhagat et al. (2005) find that diversifying takeovers have lower abnormal returns than non-diversifying transactions, but Villalonga (2004) argues that diversification is not necessarily value-destroying on average. The coefficient estimates for *Diversifying* in our study are not significant, consistent with the findings of Masulia, Wang and Xie (2007), Wang and Xie (2009), and Li et al. (2018). This section further examines whether diversifying takeovers affect the ability of intangible capital transfer to create value.

Intuitively, we may expect that intangible capital transfer generates greater value if the acquirer and the target are from related business sectors. In non-diversifying takeovers, acquirers are more likely to be able to efficiently absorb the patents, technologies, key talents, and other intangible assets from the targets. Bena and Li (2014) find that an overlapping in pre-acquisition technologies between acquirers and targets, which usually occurs in firms in the same industry, improves the innovation output post-merger. Diversifying mergers reduce the number and quality of innovations post-merger, and firms facilitate innovation activities by establishing strategic alliances and joint ventures to reconcile this reduction after conglomerate mergers (Seru, 2014).

The following specifications are included in the empirical tests. First, the tests reported in Tables 4, 5, and 6 are replicated by adding interaction terms *DINT*Diversifying*, *DOFFBS*Diversifying*, *DKNOW*Diversifying*, and *DORG*Diversifying* to the original regressions. We find that after

accounting for diversification, intangible capital transfer effects remain, but the coefficient estimates for both *Diversifying* and interaction terms are insignificant (not reported). Second, to avoid industry break with respect to industry classification, we change the industry classification from Fama-French 48 industry to Fama-French 17 industry. The coefficient estimates for organization capital transfer are significant in the regressions for acquirer abnormal announcement returns (at the 1% significance level) and synergies (at the 10% significance level). However, the impact of *Diversifying* on the dependent variables is still insignificant. Third, we repeat the original regressions based on the subsamples of diversifying and non-diversifying mergers and report the results in Table 9.

Table IV-8 Subsample Test: Check Diversification Effect

This table shows results for subsample tests of diversification. 413 diversifying mergers and 1177 non-diversifying mergers are included. The models are regressing key test variables and control variables on bidder's abnormal announcement returns, target's abnormal announcement returns, and acquisition synergy for five-days event window. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. All regressions control for year-effect and industry-effect. For the sake of simplify, the results for control variables are not reported. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

	Diversifying				**Non-diversifying**			
Panel A Acquirer Side								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5
Model								
DINT	0.0078				0.0094*			
	(1.339)				(1.806)			
DOFFBS		0.0102				0.0094*		
		(1.639)				(1.780)		
DKNOW			0.0116				0.0080	
			(1.151)				(1.180)	
DORG				0.0186*				0.0189*
				(1.711)				(1.813)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0541	0.0512	0.0559	0.0371	0.0424	0.0425	0.0493	0.0426
	(0.416)	(0.393)	(0.428)	(0.284)	(0.549)	(0.551)	(0.637)	(0.553)
Observations	413	413	413	413	1,063	1,063	1,063	1,063

Adjusted R-squared	0.145	0.149	0.146	0.148	0.152	0.152	0.150	0.152
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B Target Side								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5
Model								
DINT	0.0233				0.0059			
	(0.562)				(0.198)			
DOFFBS		0.0321				0.0000		
		(0.750)				(0.000)		
DKNOW			0.0148				0.0527	
			(0.206)				(0.975)	
DORG				0.1236*				-0.0794
				(1.824)				(-1.612)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.9017	0.8960	0.9266	0.8053	0.8381**	0.8460**	0.8192**	0.8936**
	(1.292)	(1.281)	(1.333)	(1.169)	(2.397)	(2.398)	(2.329)	(2.525)
Observations	391	391	391	391	1,016	1,016	1,016	1,016
Adjusted R-squared	0.054	0.055	0.053	0.063	0.122	0.122	0.125	0.126
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C Combined								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5
Model								
DINT	0.0044				0.0119**			
	(0.698)				(2.165)			
DOFFBS		0.0098				0.0102*		
		(1.426)				(1.829)		
DKNOW			0.0154				0.0150**	
			(1.430)				(1.997)	
DORG				0.0143				0.0122
				(1.196)				(1.028)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0990	0.0951	0.1087	0.0893	0.1347*	0.1380*	0.1428*	0.1431*
	(0.692)	(0.663)	(0.767)	(0.628)	(1.684)	(1.725)	(1.790)	(1.780)
Observations	391	391	391	391	1,016	1,016	1,016	1,016
Adjusted R-squared	0.163	0.168	0.169	0.166	0.153	0.152	0.152	0.149
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

There are 413 diversifying and 1177 non-diversifying transactions included. Excluding *Diversifying*, other control variables remain in the models. The effects of intangible capital transfer

largely remain in the non-diversifying group but not in the diversifying group. This is consistent with our prediction that non-diversifying takeovers create significant value for acquirer shareholders and overall transactions.

Combination of high-tech firms

One of the motives for the acquisitions is to obtain valuable resources such as technologies, capabilities, and skilled human capital, which appear to be more significant in intangible-intensive high-tech industry. The rapid changes in knowledge-based technologies and capabilities may not enable high-tech firms to maintain competitiveness by internally developing intangible capital (Ranft & Lord, 2000). As a result, intangible capital transfer from bidders to targets may be an important objective for high-tech mergers. However, studies have highlighted the appreciable challenges to achieve this objective and the disappointing performance for firms after mergers. The acquisition failures for technology firms could be attributed to the difficulties to integrate targets' intangible capital with acquirers' and the relatively high employee turnover caused by acquisitions (Ranft & Lord, 2000; Wang & Xie, 2009). To investigate whether intangible capital transfer creates value for acquisitions within high-tech firms, we run the regressions on subsamples of high-tech and non-high-tech combination deals. We expect the value creation ability of intangible capital transfer to be more significant for high-tech combination deals because the overlapping of knowledge may narrow the boundaries across firms.

Our sample includes 376 high-tech and 1,100 non-high-tech combination deals. In Table 10, we observe that intangible capital transfer, including knowledge capital transfer, are all significantly and positively associated with acquirer shareholder returns and synergies in the subsample of high-tech combinations. The magnitude of the coefficients for intangible capital transfer in Panel A and C are greater than those in the main regressions. However, the intangible capital transfer does not significantly affect acquirer shareholder returns in the subsample of non-high-tech combinations. These results may suggest that the market perceives the transfer of intangible capital from targets to acquirers and the utilization of such resources to enhance the acquirers' competitiveness.

Table IV-9 Subsample Test: Check High-tech Combinations

This table shows results for subsample tests of high-tech firms' combinations. 376 high-tech combinations and 1100 non-high-tech combinations acquisitions are included. The models are regressing key test

variables and control variables on bidder's abnormal announcement returns, target's abnormal announcement returns, and acquisition synergy for five-days event window. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. All regressions control for year-effect and industry-effect. For the sake of simplify, the results for control variables are not reported. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

	High-tech Combination				**Not High-tech Combination**			
Panel A Acquirer Side								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5
Model								
DINT	0.0104**				0.0023			
	(2.000)				(0.493)			
DOFFBS		0.0106*				0.0043		
		(1.905)				(0.955)		
DKNOW			0.0134*				-0.0002	
			(1.792)				(-0.029)	
DORG				0.0242**				0.0108
				(2.168)				(1.163)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0429	0.0483	0.0499	0.0468	0.0349	0.0315	0.0378	0.0287
	(0.284)	(0.319)	(0.327)	(0.313)	(0.521)	(0.471)	(0.567)	(0.431)
Observations	376	376	376	376	1,100	1,100	1,100	1,100
Adjusted R-squared	0.235	0.235	0.233	0.237	0.109	0.110	0.109	0.110
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B Target Side								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5	TGTCAR5
Model								
DINT	0.0079				0.0180			
	(0.296)				(0.736)			
DOFFBS		-0.0037				0.0285		
		(-0.149)				(1.139)		
DKNOW			-0.0232				0.0628	
			(-0.584)				(1.600)	
DORG				0.0311				0.0030

				(0.663)				(0.063)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.4679***	1.4794***	1.4828***	1.4659***	0.5324*	0.5154*	0.5247*	0.5578*
	(2.627)	(2.643)	(2.661)	(2.611)	(1.800)	(1.736)	(1.781)	(1.852)
Observations	351	351	351	351	1,056	1,056	1,056	1,056
Adjusted R-squared	0.139	0.139	0.140	0.140	0.127	0.129	0.132	0.127
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel C Combined

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5	Synergy5
Model								
DINT	0.0145***				0.0037			
	(2.715)				(0.698)			
DOFFBS		0.0126**				0.0066		
		(2.146)				(1.276)		
DKNOW			0.0197**				0.0076	
			(2.082)				(1.146)	
DORG				0.0221*				0.0094
				(1.888)				(0.821)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.1437	0.1528	0.1559	0.1528	0.0900	0.0853	0.0914	0.0876
	(1.040)	(1.101)	(1.119)	(1.110)	(1.345)	(1.280)	(1.368)	(1.294)
Observations	351	351	351	351	1,056	1,056	1,056	1,056
Adjusted R-squared	0.110	0.106	0.105	0.103	0.170	0.171	0.170	0.170
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

V Additional Robustness Tests

A. Endogeneity

Two major endogeneity concerns in this paper may prevent us from concluding that acquisition performance is improved by transfer of intangible capital from targets to acquirers. The first endogeneity concern is the omitted variable. Some unobservable factors could affect both intangible capital transfers (*DINT*, *DOFFBS*, *DKNOW*, and *DORG*) and the performance of takeovers (*ACQCAR5*, *TGTCAR5*, and *Synergy5*). To address this concern, a set of control variables for firms, deal, and CEO characteristics have been incorporated following the related works of Masulis et al. (2007) and Wang and Xie (2009). The tests for the three hypotheses in this study are based on firm-level estimates of intangible capital. However, intangible capital intensities have been changing over time, and this intensity is also likely to vary across industries. For example, technology, consumer, and pharmaceutical industries have higher intangible capital intensity than manufacturing, and the intangible intensities for the former also increased more rapidly from 1975 to 2010 than manufacturing (Peters & Taylor, 2017). The firm-level measurements of intangible capital may fail to account for variations in time and industry. As a result, we control the year and industry fixed effects to eliminate the effect of these variations.

In addition, acquirer fixed effects are also applied to account for the effect of potential heterogeneity in unobserved bidder characteristics such as the bidder's ability to execute better (poorer) deals. The findings persist when controlling for acquirer fixed-effects. Moreover, the magnitude of the coefficients for intangible capital transfer proxies are greater than those in the main regressions for testing the acquirer announcement returns. The coefficient estimates for *DINT*, *DOFFBS*, *DKNOW*, and *DORG* after controlling acquirer fixed-effects are 0.0099, 0.0113, 0.0092, and 0.0218, respectively, while for the main regressions the coefficients are 0.0084, 0.0092, 0.0072, and 0.0206, respectively.

Some studies have the applied instrumental variable method to address the endogeneity issue related to the choice of test variables. If an exogenous shock to the regression residual affects both dependent variables (shareholders' returns) and independent variables (i.e., transfer of intangible capital), the independent variables will be correlated with the residual term, resulting in the

inconsistent estimates. Using an instrumental variable that captures the intangible capital transfer in acquisitions but is not related to other independent variables is an appropriate way to solve the problem. However, this endeavour cannot be applied to our studies because of the unavailability to find a strong instrument to capture the transfer of intangible capital. The state-level variables, unemployment insurance benefits and the Inevitable Disclosure Doctrine by U.S. state courts, which are adopted by Li, Qiu, and Shen (2018) to predict organization capital, may not necessarily be able to capture the transfer of organization capital of firm-level. The selection of an instrument that interprets little of variation of endogenous independent variables can cause large inconsistency in the estimates (Bound, Jaeger, & Baker, 1995). As a result, we do not adopt the instrumental variables approach in our research.

Another endogeneity concern is possible reverse causality, that is, target firms may strategically or deliberately invest in building intangible assets but strategically underinvest in assets in order to make themselves attractive targets for acquirers. Phillips and Zhdanov (2012) argue that small firms have increased incentives to innovate more to increase the possibility of being taken over by large firms. However, target firms of this type do not necessarily achieve higher abnormal announcement returns in acquisitions. In this sample, neither target intangible capital nor its components had a significant effect on target shareholders' abnormal announcement returns. Therefore, the relationship between pre-takeover target intangible capital and deal performance is likely to be causal.

B. Sensitivity Tests

Below we discuss additional sensitivity tests of our findings with respect to our choice of proxies for abnormal announcement returns. The analysis so far has relied on cumulative abnormal announcement returns (*CAR*) for a short-term event window [-2, +2] based on the market model. The short-term event study approach has been applied to many studies based on the assumption that the stock market is efficient: i.e. stock price fully reflects publicly available information, and a massive volume of stocks are traded around the event days. The five-day event window is widely used by other research (e.g. Fuller et al., 2002; Masulis et al., 2007). Fuller et al. (2002) argue that using event day [-2, 2] reduces noise because the announcement dates in SDC are off by no more than two trading days. However, there are also a number of studies using an alternative [-5, 5]

event window (e.g. Bradley et al., 1988; Lang et al., 1989; Wang & Xie, 2009; Hegde & Mishra, 2017). This event window is longer and able to capture the possible effects of information reaching investors before the announcement date. Therefore, the announcement effect is estimated by extending the event window to gather more information (additional noise may be included as well). The long-run event study approach, buy-hold abnormal returns (*BHAR*), is utilized to measure long-term abnormal stock returns, although according to Barber and Lyon (1997), the difference between *CAR* and *BHAR* may not be significant in short horizons. Different valuation models are applied to eliminate the model bias.

The results are robust for the following alternative specifications of the empirical tests conducted: 1) we measure *CAR* over an alternative event window [−5, 5], and measure weighted synergy accordingly using 11-day abnormal returns; 2) we alternatively replace *CAR* with *BHAR* for both acquirer and target over event days [-2, +2] and [−5, 5], and measure weighted synergy accordingly using abnormal returns; 3) we measure *CAR* and *BHAR* using the Fama-French three-factor model and the Fama-French plus momentum model over event days [-2, +2] and [−5, 5], and measure weighted synergy accordingly using abnormal returns.

Furthermore, additional sensitivity tests are conducted: 4) We add the number of bidders as control variables because bidder returns may drop as competition for the target increases (Bradley et al., 1988); 5) We exclude industries of regulated utilities (SIC codes 4900-4999), financial firms (SIC codes 6000-6999), and firms categorized as public service, international affairs, or non-operating establishments (SIC codes 9000+) because the intangible capital measurement may not be appropriate for these industries (Peters & Taylor, 2017). Table 11 presents the results after excluding the above industries. All coefficient estimates for intangible capital transfer proxies on bidder returns (Panel A) and the combined returns (Panel C) are positive and significant, and the coefficient estimates on target returns are insignificant. Thus, the conclusion reached in the main regression persists for these tests; 6) We control for target's pre-announcement stock price runup, which may significantly affect both bidder and target abnormal announcement returns. The market's anticipation of potential acquisition attracts informed trading, leading to a runup in target stock price before the acquisition announcement (Brigida & Madura, 2012). Acquirers may not be able to fully adjust bidding premium to account for the targets' pre-bid runup. Schwert (1996) points out that at least two-thirds of targets' pre-bid runup is added to the premium paid by

successful bidders, resulting in the increase of the cost of acquiring targets. We measure the target stock price runup by buy-and-hold abnormal returns over the 200-day window (event day -205 to event day -6) with the market model. Our findings remain after controlling the target stock price runup prior to the announcement.

Table V-1 Robustness Tests for Industries

This table shows results for robustness tests of key test variables and control variables on five-day bidder's abnormal announcement returns, target's abnormal announcement returns, and acquisition synergy. Test variables are transfer of firms' intangible capital from targets to acquirers, including *DINT*, *DKNOW*, *DORG*, and *DOFFBS*. Control variables cover characteristics of acquirers, targets, acquirers' CEOs, and deals. All regressions control for year-effect and industry-effect. Industry of regulated utilities (SIC codes 4900-4999), financial firms (6000-6999), and firms categorized as public service, international affairs, or non-operating establishments (9000+) are excluded from the original sample. The new sample consists of 1,070 complete U.S. mergers and acquisitions from 1993 to 2014. For the sake of simplify, the results for control variables are not reported. All variables are estimated at the end of fiscal year before the announcement day. Robustness *t*-statistics are in parentheses. ***, **, and * stand for the statistical significance level at 1%, 5%, and 10%, respectively.

Panel A: Acquirer Side				
	(1)	(4)	(2)	(3)
	ACQCAR5	ACQCAR5	ACQCAR5	ACQCAR5
Model				
DINT	0.0097**			
	(2.417)			
DOFFBS		0.0100**		
		(2.464)		
DKNOW			0.0088*	
			(1.703)	
DORG				0.0198**
				(2.488)
Control Variables	Yes	Yes	Yes	Yes
Constant	0.0897	0.0914	0.1032	0.0880
	(1.073)	(1.093)	(1.229)	(1.053)
Observations	1,028	1,028	1,028	1,028
Adjusted R-squared	0.144	0.144	0.141	0.145
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes
Panel B: Target Side				

	(5) TGTCAR5	(8) TGTCAR5	(6) TGTCAR5	(7) TGTCAR5
Model				
DINT	0.0172			
	(0.729)			
DOFFBS		0.0112		
		(0.466)		
DKNOW			0.0394	
			(0.896)	
DORG				-0.0133
				(-0.318)
Control Variables	Yes	Yes	Yes	Yes
Constant	0.6810*	0.6978*	0.6961*	0.7293*
	(1.699)	(1.733)	(1.732)	(1.822)
Observations	968	968	968	968
Adjusted R-squared	0.112	0.112	0.114	0.112
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes
Panel C: Combined				
	(9) Synergy5	(12) Synergy5	(10) Synergy5	(11) Synergy5
Model				
DINT	0.0102**			
	(2.251)			
DOFFBS		0.0097**		
		(2.178)		
DKNOW			0.0120*	
			(1.959)	
DORG				0.0152*
				(1.662)
Control Variables	Yes	Yes	Yes	Yes
Constant	0.1825**	0.1876**	0.1974**	0.1886**
	(2.098)	(2.159)	(2.272)	(2.161)
Observations	968	968	968	968
Adjusted R-squared	0.134	0.133	0.132	0.132
Year Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Acquirer Clustering	Yes	Yes	Yes	Yes

VI Conclusion

Based on a sample of 1,607 completed M&As transactions for U.S. public firms from 1993 to 2014, we provide evidence that intangible capital transfers from target to the acquirer, where intangible capital is measured as the sum of on-balance-sheet intangible capital and capitalized R&D and SG&A expenses, and this transfer is positively associated with acquisition performance. By regressing the transfer of intangibles on deal performance proxies, we find that intangible capital transfer has a significantly positive effect on five-day bidder shareholder abnormal announcement returns and overall acquisition synergistic gains after controlling for firm, bidders' CEO, and deal characteristics, supporting the hypothesis that acquisitions of high-intangible targets by relatively low-intangible acquirers create value for the acquirers' shareholders and overall transactions. The intangible capital transfer does not appear to be valuable to the targets' shareholders. Additional analyses show that the value creation potential of intangible capital transfer is significant for non-diversifying deals, high-tech mergers, and firms in competitive industries.

We also separately investigate the transfer effects of off-balance-sheet intangible capital, knowledge capital, and organization capital. Results show that the magnitude of the contribution from the off-balance-sheet intangible capital transfer is higher than total intangible capital transfer, and the contribution from organization capital transfer is greater than that from knowledge capital transfer.

Overall, acquisitions involving intangible capital transfer from targets to acquirers not only benefit to acquirers' shareholders but also create additional value for the economy. Our study offers evidence demonstrating that intangible capital transfer, especially organization capital transfer, is an important channel of value creation in M&As.

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Appendix: Variable Definitions

Variable	Definition	Source
CAR5, CAR11	The cumulative abnormal returns from 2 days before event day to 2 days after the public announcement estimated using the market model based on the Centre for Research in Stock Prices (CRSP) equally weighted index, see Masulis et al. (2007).	CRSP
ACQCAR5, ACQCAR11, TGTCAR5 and TGTCAR11	*ACQCAR5* is acquirer *CAR5*, *ACQCAR11*, *TGTCAR5* and *TGTCAR11* are acquirer *CAR11*, target *CAR5*, target *CAR11* respectively.	CRSP
Synergy	The combined returns calculated as the weighted average returns of acquirers and targets.	Authors' computation
INT	Intangible capital estimated as the sum of the firm externally purchased and internally created intangible capital (Peters & Taylor, 2017).	Peters and Taylor Total Q
KNOW	Knowledge capital replacement cost is measured by accumulating past R&D spending using the perpetual inventory method (Peters & Taylor, 2017).	Peters and Taylor Total Q
ORG	Organization capital replacement cost is estimated by accumulating a fraction (30%) of past SG&A spending using the perpetual inventory method (Peters & Taylor, 2017).	Peters and Taylor Total Q
OFFBS	Off-balance-sheet intangible capital is the portion of intangible capital replacement cost that doesn't appear on firm's balance sheet (Peters & Taylor, 2017).	Peters and Taylor Total Q
DINT, DKNOW, DORG, DOFFBS	DINT measured as Target INT less Acquirer INT as of beginning of the acquisition year. DKNOW, DORG, and DOFFBS are measured using same method.	Authors' computation
Size	Natural logarithm of total assets of the firm as of fiscal year-end prior to acquisition announcement.	Compustat/Authors' computation
Tobin's Q	Ratio of market value of assets (as measured by the market value of its outstanding stock and debt) divided by book value of assets.	Compustat/Authors' computation
Leverage	Book value of debts (as measured by long-term debt plus debt in current liabilities) divided by book value of assets.	Compustat/Authors' computation
Return on Assets (ROA)	Operating income before depreciation divided by total assets.	Compustat/Authors' computation
Delaware	Dummy variable equals to 1 if current state or province of incorporation is Delaware.	Compustat
Tender Offer	Dummy variable equals to 1 if deal is reported as tender offer by SDC.	SDC platinum

Cash Only	Dummy variable equals to 1 if consideration structure reported by SDC is pure cash.	SDC platinum
Merger of equals	Dummy variable equals to 1 if the deal is reported as merger of equals by SDC, 0 otherwise.	SDC platinum
High Tech	Dummy variable equals to 1 if both acquirer and target are from the high-tech industries, see Loughran and Ritter (2004).	SDC platinum
Diversifying	Dummy variable equals to 0 if both acquirer and target are from same Fama-French 48 industries groups.	SDC platinum
Hostile	Dummy variable equals to 1 if deal attitude reported by SDC is hostile.	SDC platinum
Relative Ratio	Relative size defined as target market value divided by acquirer market value.	Compustat/Authors' computation
HHI	Herfindalhl-Hirschman Index estimated as the sum of the squared market shares of the firms in the industry. Market share is calculated as the firm sales divided by industry sales.	Compustat/Authors' computation
Competitive	Dummy variable equals to 1 if HHI is greater than 0.15, 0 otherwise.	Authors' computation
Log CEO Age	Natural logarithm of CEO ages.	Compustat Execucomp
CEO Female	Dummy variable equals to 1 if gender of CEO of fiscal year is female.	Compustat Execucomp
Log CEO Tenure	Natural logarithm of monthly tenure of named CEO.	Compustat Execucomp/Authors' computation
CEO Ownership	Percentage of company's total shares owned by CEO.	Compustat Execucomp
Log, Value of Exercisable Options	Natural logarithm of manager's in the money unexercised exercisable options.	Compustat Execucomp/Authors' computation